The FOUNDRY

Volume 57
Number 21

Published
Semimonthly

CLEVELAND, OHIO, NOVEMBER 1, 1929

Castings Help To Maintain Law and Order

WHILE the police departments in Chicago, Detroit, Cleveland and other metropolitan centers are speeding the capture of criminals through the use of radio, and it is conceivable similar equipment may find a place in the city fire fighting equipment of the future, telephone and telegraph are the chief means of communication for both the

Police Call and Fire Alarm Boxes Used Extensively in Cities Are Made Of Castings

police and fire departments. The protectors of law and order have telephone boxes scattered throughout the city so that policemen on the beat may report at regular intervals and emergency calls may be made to headquarters. The city also is dotted with fire alarm boxes which automatically turn in the alarm when the glass is broken and the handle pulled down. They register the box number which is the approximate location of the fire at a central station. Private agencies guarding office buildings, factories and yards also use special telegraph equipment, with boxes placed at various points throughout the property being guarded. Boxes for police and fire departments and often the special watchmen stations, are placed on poles or buildings and must withstand the rigors of the elements and the attacks of smoke and fumes. For that reason and its ability for faithful reproduction cast iron is used almost exclusively for this type of product.

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PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

CHICAGO ..... 1347 Peoples Gas Bldg.
CINCINNATI ..... 209 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
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PARIS, FRANCE ..... No. 9 Rue de Londres
BERLIN, GERMANY ..... Dahlmerstrasse 64A, Berlin, Lichterfeld-West

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single Copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each.

Member, Audit Bureau of Circulations, Associated Business Papers Inc., National Publishers' Association

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SMOOTHING

Growing Demand for New Ideas in Kitchen Stoves Has Been Met by Advanced Casting Practice in Plant Foundry

By Pat Dwyer

Fig. 1—Combination Coal and Gas Fired Stoves Are Produced

Fig. 2—The Pattern Is Rapped Down at Certain Places To Increase the Thickness and Thus Prevent the Casting from Warping

BENJAMIN Franklin, probably greatest of all Americans, initiated many far reaching movements, social, economic and industrial during a long residence in his adopted city of Philadelphia.

At the moment of inception, or when the originator first introduces his idea to the public, the action may be compared to dropping a small pebble in the water. It makes little noise, but the ripples spread in ever widening circles for a considerable period. Franklin dropped a sufficient number of pebbles to keep the placid old mill pond of Philadelphia in a continuous ripple and some of the ripples have not yet subsided.

He built the first rocking chair. He laid a sidewalk in front of his house and kept it swept clean as an incentive to his neighbors. He placed a lamp post in front of his gate for the same reason and he designed a small cast iron stove. This stove was to take the place of the huge fireplace definitely located in a certain position in one room of the house. The new stove could be moved to any point in the room, and, if necessary, moved from one room to another.

The foregoing incidents, the rocking chair, the clean sidewalk and the lamp post, would seem, according to the modern viewpoint, to indicate the presence behind the scenes of an extremely busy, not to say nagging, Mrs. Franklin. History, as in many other instances in the lives of great men, is discreetly silent on this point.

An ardent exponent of, and believer in economy, efficiency, neatness and comfort, he realized how sadly the big open fireplace failed to measure up to all these requirements. The fact that it had been accepted as standard household equipment for generations did not appeal to Franklin as an argument of any weight. Upward and onward was his motto and let the dead past bury its dead.

The open fireplace, the chimney hook and the crane attached to the side wall of the stone or brick fireplace disappeared from the kitchens as

Wrinkles in Stove Making

a result of Franklin's invention. Naturally they did not disappear over night. Manufacturing facilities and methods of distribution required time to develop, but in the middle of the past century many flourishing stove centers had come into existence. Stove founders begged, borrowed, bought and—in some instances it is hinted—stole patterns from each other. As the years went by new, larger, better and more elaborate stoves were designed, but every stove manufacturer kept at least one size and sometimes two sizes of the Franklin stove in the sand. Recent statistics on the subject are not available, but a diligent survey of the country doubtless would disclose a great number of these famous stoves still in use.

Extent to which the stove industry of the United States has expanded since Franklin gazed with a creator's pride on the first specimen is shown briefly in a recent issue of a department of commerce publication entitled *Statistical Abstract of the United States*. Number of establishments engaged in the production of stoves (other than gas, oil or electric) is given as 323; wage earners 29,376; wages paid $41,493,000; cost of materials $47,249,000; value of products $140,805,000; value added by manufacture $93,556,000; primary horsepower employed 63,545. The same items under the heading Gas Stoves and Appliances are given as: Number of establishments 241; wage earners 17,138; wages paid $24,806,000; cost of materials $48,024,000; value of products $123,498,000; value added by manufacture $74,874,000; primary horsepower employed 30,581.

Considering the fact that each of the principal stove manufacturers makes a diversified line of stoves to burn wood, coal, oil, gas or use electric current, one may be pardoned for hesitating to accept the foregoing arbitrary division of establishments into two classes; gas, oil and electric in one and all others in the second. Quite possibly some of the figures overlap, but even so, it is apparent that stoves may be classified as a leading product and stovemaking as one of the major industries.

At the time Franklin placed the order for his first stove the

Fig. 3 (Left)—Many of the Smaller Molds in Snap Flasks Are Squeezed on Machines. Fig. 4 (Below)—Castings Are Cleaned in Rectangular and Cylindrical Tumbling Barrels

Fig. 5—Accuracy Is Prime Requisite in Fitting the Various Parts Together

number of foundries—as foundries are known today—in the state of Pennsylvania, could be counted without referring to the usual fingers or toes. All metal was poured direct from the blast furnace. The first cupola was not placed in operation until 1821, thirty years after Franklin had passed through the final Pilgrim's door at the end of his long journey.

Has Many Foundries

Today and for many years, Pennsylvania with a total of 850 foundries outranks any of the other states in this respect. Many of these foundries are devoted to the manufacture of stoves and although none can trace direct descent from the plant where the first Franklin stove was made, several have been in existence for many years.

Typical in this respect is the plant of the Prizer-Painter Stove Works, Reading, Pa., first organized and placed in operation in 1888. Advancing age of the principals and other factors brought about a reorganization in 1910. Since that time it has been controlled and operated by the present owners with W. B. White as secretary-treasurer and general manager of the reorganized company.

The foundry proper has not been changed to any great extent, but other departments have been added from time to time to meet popular demand and to keep pace with development in the stove making field. The present plant is fully equipped to nickel plate the castings and to enamel all the parts which present day customers expect to find finished in that manner. Sheet steel enters to an appreciable extent into the construction of the modern stove. The Prizer-Painter company maintains an extensive sheet metal shop for the fabrication of all the material required. One of the two enameling ovens is devoted to the treatment of sheet metal parts.

Under present day conditions the stove manufacturer to a considerable extent finds himself in the same position as the automobile builder, forced to bring out new models with increasing frequency. Between this development work and the maintenance of patterns actually in production, a number of patternmakers constantly are employed in a space set apart for the purpose and fitted with the necessary tools and equipment on the second floor of the main building adjoining the foundry proper.

Fig. 7—New Models Which Are to Keep Patternmakers Constantly Employed

Fig. 6—Assembled Stove Tops Are Ground and Finished Smoothly on an Automatic Machine

Practically all the patterns are cast iron and are molded in the foundry by one of the regular molders specially skilled in this branch of the trade. In some instances the pattern is an exact replica of the casting desired in size, shape and thickness, with the exception of course, that the overall dimensions are slightly greater to compensate for contraction. In other instances the pattern takes the form of a matchplate with the cope impression on one side, the drag im-

pression on the other side and with a solid iron plate between and extending all around the edge. The thickness of the plate varies between ¼ and ⅜-inches depending on several features, including the total length and width of the pattern.

The mold for one of these plates in process of construction is shown in Fig. 9. The method is standardized, but only a man with a considerable background of practical experience and skill can be entrusted with the job of carrying it out properly. He must know in advance if the shape or thickness of the plate will cause it to warp while cooling. If necessary he must know how to manipulate his mold to insure a straight casting from a mold that under ordinary conditions would produce a casting warped away from the true shape.

Fig. 9—After the Cope Is Removed the Matchplate Molder Builds a Thickness of Sand Around the Edges on the Face of the Drag

Fig. 8—Two Transfer Cages Are Employed In Loading and Unloading the Car Which Conveys the Castings Into the Enameling Oven

In some instances the shape, size and position of the gates are the determining factors in the ultimate accuracy of the casting. In other instances, variations of metal thickness at certain points affect the uniform cooling of the casting and set up certain strains that are reflected in the shape of the casting when it is shaken out.

The foregoing features applying to the patterns and matchplates also apply to the stoveplate castings made from any of these pieces of equipment. Many of the castings present no particular hazard. The castings come out of the sand true to shape without any special precautions on the part of the molder. Large frames, tops and oven doors frequently require special manipulation to insure castings true to shape.

These little peculiarities are noted when the pattern first goes into production and every precaution is taken to insure a perfect casting. In the event that a pronounced tendency to warp is noted, slight adjustments are made in the process of molding succeeding castings. A change in the shape or position of the gate or gates, may be sufficient. Another reliable method of preventing a certain casting from warping is to increase the thickness of metal in certain areas.

Prevents Warping

For example where an oven door shows a tendency to curl up at the ends, it is prevented by rapping the ends of the pattern down into the sand before the pattern is removed from the drag. The increased thickness secured in this manner in some instances is almost negligible, but it is sufficient to equalize the cooling speed of the casting and prevent it from warping.

In other instances the procedure is reversed and the center of the plate is rapped down instead of the ends. Usually, but not invariably, the increased thickness has to be applied

Fig. 10—The Floor Has Been Built Up Close to the Spout to Facilitate Catching the Metal In Hand Ladles. The Cupola on the Right Was Used in a Former Generation

at the area most remote from the gates. Thus in a plate gated at the ends, the rapping would be done in the center, while a center gated pattern would be rapped over the ends. However, as stated previously, the position of the gates is one of the most important features in stove plate molding. In a few instances a choice of several positions is available, but in the great majority of instances trouble will ensue if the gates are not placed in a certain, definite manner and position.

Special Gates

Method adopted for gating a firepot casting is shown in Fig. 11. At first the runner did not extend beyond the cope parting where three branches conducted the iron into the upper edge of the casting. The falling metal caused the sand on the shoulder to cut and scab. Possibly a different grade of sand might have withstood the stream satisfactorily, but the foundryman naturally followed the line of least resistance. The sand was used without trouble on all the other castings, therefore why should he tinker with a special supply to mold the firepots. He introduced a couple of auxiliary gates a few inches above the bottom of the pattern and has had no scabbed castings since.

The vertical runner extends almost to the bottom of the sand on the inside of the pot. The pattern is pierced with two ⅜-inch holes diametrically opposite each other and 4 inches above the bottom edge of the pattern. Two ¼-inch rods are placed in these holes before the inside of the pattern is filled with sand. The inner end of each rod is pointed and rests in a pocket in the upright runner stick. The outer end projects 3 inches outside the pattern. The rods are removed after the drag has been rolled over. Where the pattern is not rolled, but placed directly on the level face of a rammed drag, the rods are removed before the cheek part of the flask is placed in position. The light gates readily are broken out of the casting after the mold is shaken out. They break off close to the face of the pot on the inside and the trace of the stump that remains requires no further treatment.

With the exception of two air squeeze machines made by the Osborn Mfg. Co., Cleveland and one hand squeeze machine made by the Arcade Mfg. Co., Freeport, Ill., all the other molding operations are performed on floors typified by that shown in Fig. 2. The molder makes the molds and pours his own iron. Then his duties cease for the day. A special gang shakes out the castings, stacks the flasks on end as shown in the illustration, ready for the following day, removes the castings to the cleaning room and wets down the sand. A machine made by the American Foundry Equipment Co., Mishawaka, Ind., cuts the sand into long heaps extending from the gangway to the wall. Thus when the molder appears in the morning he can commence molding without delay.

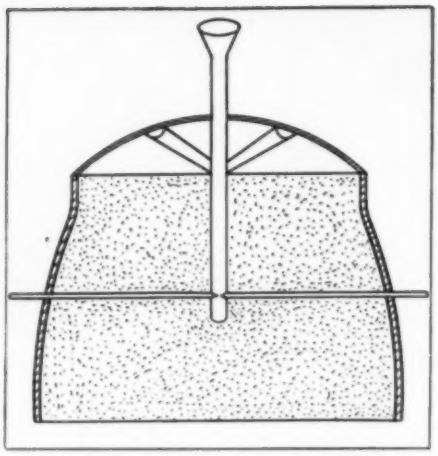


Fig. 11—Auxiliary Gates Prevent Sand From Cutting

Wood Flasks

Wood flasks are employed exclusively. Many of the flasks are hinged at one side as shown in Fig. 2 and thus may be handled by one man whether filled with sand or empty. A skilled stoveplate molder moves at high speed with the number of moves cut down to the absolute minimum. Therefore he has no time to waste in waiting for lifts or in giving them.

Fig. 12—Castings Are Sprayed With Liquid Enamel

He stays strictly on his own floor where he opens and closes his molds by himself.

Each flask is equipped with a hasp at each end by which cope and drag are clamped together firmly while the molder is ramming sand in the cope. This precaution prevents the cope from moving and a subsequent shutting off of the mold opening when the cope is replaced and clamped in position for pouring. Absolute accuracy must be maintained at every stage in the production of these thin castings.

The castings are cleaned in a battery of tumbling barrels supplied by the Whiting Corp., Harvey, Ill., and in a sandblast barrel made by the New Haven Sandblast Co., New Haven, Conn. Large, flat castings are tumbled in rectangular barrels where they can be packed with greater efficiency than in the circular type. The barrels are driven in pairs and are equipped with suction pipes which remove the dust. Castings to be enameled are sandblasted in a chamber attached to the enameling room. An operator armed with a hose works in this chamber which was installed and equipped by the Pangborn Corp., Hagerstown, Md.

Liquid enamel in any desired color is sprayed on the clean castings in the booth shown in Fig. 12. The enameled castings are placed on the rack shown in Fig. 8 suspended from a permanent framework. Here they are allowed to air dry, while the load on a second similar rack is undergoing treatment in the enameling oven. The rack load of castings remains in the oven for approximately half an hour and is raised to a temperature of 1400 degrees Fahr. Then it is removed and the second loaded rack takes its place. The rack is supported on the lower part of the frame of a transfer cage which travels suspended from a track above the track and entrance to the oven. The car which enters the oven is made up of long, heavy steel beams and is equipped with a lifting apparatus by which the rack load of castings may be removed from the suspended cage. On the return journey the body of the car is lowered to leave the loaded rack once more on the lower part of the cage.

Fit the Parts

Castings which form the interior mechanism of the stove are taken directly from the cleaning room to the assembly floor. Many of the outside parts, exclusive of those which are enameled are taken to an adjoining room fitted up with the necessary tanks and other equipment, where

(*Concluded on Page* 935)

BRITISH FOUNDRYMEN *Cast* *Variety of Alloys*

Part I—Cast Iron

By Thomas H. Turner

IN THE preparation of this account of the alloys cast in his native land, the author has endeavored to answer these questions by reviewing the many alloys commonly available as castings. The data reproduced are all the product of inquiries to individuals or firms actually engaged in the foundry business at the present time.

The majority of the figures have been given as typical of castings made commercially, but in some few cases they are figures obtained by the author on testing samples given him by the producers. In no case has the data given been abstracted from existing text books, for text books and scientific papers contain references to hundreds of alloys which have only been made once by one worker.

Covers Ferrous and Nonferrous Alloys

It is hoped that reference will be found to all the important groups of alloys, used as castings, irrespective of whether they are ferrous or nonferrous. The standardized alloys are mentioned wherever possible, but in many cases the alloys have not yet been standardized.

For convenience they have been considered under the following arbitrary groupings: Cast Irons—high carbon iron alloys, containing graphite; Cast Steels—iron rich alloys free from graphite; Cast Yellow Metals—alloys rich in copper, and yellowish in color; Cast White Metals—low melting point alloys of tin, lead, antimony or zinc; Cast Light Alloys—alloys rich in aluminum or magnesium; and Cast Resistant Alloys—alloys much influenced by nickel or chromium.

Extensive as this review of present foundry practice may be, it inevitably suffers from gaps, due in part to the ignorance of the author and in part to the fact that all foundrymen have not accepted as yet the truth that it is more blessed to give than to receive knowledge.

Nevertheless, if the following sections make a useful contribution to the international science of metallurgy, they do so because of the generous help the author has received from many British foundrymen and engineers who knew his objective and freely gave details of their practice or materials, for use in this paper.

Compilation of this data regarding current practice has entailed many works visits and much correspondence, and the author gratefully acknowledges his indebtedness to all who have so kindly helped him in his task and especially to the British Engineering Standards association for permission to make extracts from some of the British standard specifications relating to castings.

Standards Not Universal

Use of standard specifications for cast iron has not become universal in Great Britain as is practically the case with some of the more common nonferrous foundry alloys. The reason for this is obvious, in that the types and varieties of cast iron are many, as are the purposes to which this material is put. Although customers occasionally quote British Engineering Standards association, air board, or their private specifications, it usually is left to the foundry to supply the castings in the most suit-

Covers All Fields

PROGRESSIVE foundrymen in this country who like to keep in touch with foundry developments in all parts of the world will be interested in this voluminous work which includes chemical and physical data on the numerous ferrous and nonferrous alloys which are cast in Great Britain at the present time. As the author states, data presented is taken from actual practice. This is the first article of a series giving information on casting alloys used in Great Britain and is abstracted from a paper presented in behalf of the Institute of British Foundrymen at the meeting of the Association Technique de Fonderie held in Paris, France, on Oct. 25 and 26. The author is lecturer in metallurgy, University of Birmingham, Birmingham, England.

Table I

Cast Iron Piston Ring Pots

Chemical Composition	Sand Castings	Chill Castings
T.C	3.50 max.	3.50 max.
C.C.	0.55-0.80	0.45-0.80
Si	1.80 max.	1.80-2.50
Mn	0.40-1.20	0.40-1.20
S	0.12 max.	0.12 max.
P	1.00 max.	1.00 max.

Table II

Cast Iron for Pistons, Etc.

	K.11.(A).	K.11.(B).	K.12.
T.C.	2.7 -3.5	2.7-3.3	2.7-3.5
C.C.	.5 -.8	0.5-0.8	0.5-0.8
Si	1.2 1.8	1.2-1.8	1.2-2.0
Mn	0.35-0.80	0.6-1.2	0.5-1.2
S	0.12 max.	0.12 max.	0.08 max.
P	0.80 max	1.1 max.	0.08 max.

Table III

Malleable Cast Irons

	White Heart	Black Heart
Max. sulphur content	0.40	0.10
Max. phosphorus content	0.20	0.20
Minimum U.T.S. pounds/sq. in.	44,800	44,800
Minimum elongation % on 2 in.	5	7.5
Minimum bend—degrees	45	90

able material. Therefore in this respect the degree of confidence existing between purchaser and producer is an important point.

Strength, hardness and machinability of cast iron varies so greatly with changes in section, that this is necessarily considered in the British Engineering Standards association specifications. Breaking loads therefore are specified for test bars from 0.75 to 2.30 inches in diameter, in regard to many general gray iron castings.

Attitude of makers and users of gray iron castings towards chemical analysis has undergone much change in the past 20 years, but considerable latitude still is permitted as regards composition, as will be seen in the following references to individual specifications, some of which are prefaced by paragraphs such as the following:

> "The chemical compositions called for in the British standard specifications for Cast Iron and Malleable Cast Iron for Automobiles are considered to be of less importance than the mechanical tests required. The limits of the compositions, accordingly, have been set as wide as possible and represent the extreme proportions of the different constituents which may be present in a good and serviceable material. It is considered desirable, therefore, in the use of these specifications that the mechanical properties should be regarded as the main requirements and the chemical composition as an auxiliary check upon the suitability of the material to perform the duties laid upon it."
>
> "Further, it is recommended that with each batch of castings delivered the manufacturer should furnish to the purchaser a signed certificate giving the results of the chemical analysis and mechanical tests carried out."

Many of the British Engineering Standards association standard specifications for cast iron articles concern themselves almost exclusively with dimensions, tolerances, and such purely engineering details. Pipes and fittings must be made according to specifications which have been in use for nearly 20 years, from "remelted iron and the metal shall be dark gray on fracture," but the metal composition is in no way specified. In some cases it is specified that the remelting shall be in the cupola or air-furnace.

Recently issued British Engineering Standards association specification for general gray iron castings, Grades *A* and *C*, (No. 321—1928), states that the castings shall be cast from metal melted in any metallugical plant, other than an iron-ore smelting furnace. This is somewhat different wording from that in the older specifications referred to previously, but it means much the same. The chemical composition of the iron as cast to this recent specification again is left to the discretion of the manufacturer, but if desired, the purchaser may specify a maximum percentage of phosphorus. Breaking loads are specified carefully in this specification for test bars from 0.75 to 2.30 inches in diameter. In several specifications drawn up in 1924, the chemical composition only limits the sulphur and phosphorus contents; in all cases 0.12 per cent being the maximum for sulphur, and 1.20 per cent being the maximum for phosphorus.

For iron castings for air-cooled and jacketted cylinders for automobiles (No. 5024—1924) no heat treatment is permitted. This also applies to iron castings for flywheels for automobiles (No. 5026—1924), but heat treatment up to 500 degrees Cent. (932 degrees Fahr.) is permitted for piston castings, after they are removed from the mold, according to the specification for iron castings for sand-cast pistons and valve guides for automobiles (No. 5025—1924.)

Table IV

Data on Cylinder Irons

	No. 1 Per cent	No. 2 Per cent	No. 3 Per cent	No. 4 Per cent
Combined Carbon ($\frac{1}{2}$-inch section)	0.6	0.6	0.65	0.55
Total Carbon	3.2	3.2	3.1	3.4
Silicon	1.9	1.4	1.8	1.2
Manganese	0.80	0.80	0.80	0.70
Sulphur	0.08	0.08	0.08	0.08
Phosphorus	0.90	0.90	0.25	0.60
Nickel	.....	.....	1.25	.....
Chromium	.....	.....	0.35	.....
Ultimate Strength (on $\frac{1}{2}$-inch square section turned from $1\frac{1}{2}$-inch cast bar) in pounds per square inch	29,000 to 38,000	29,000 to 38,000	33,600 to 44,800	29,000 to 35,800
Transverse Test (1-inch sq. cast bar, 12-inch centres) in pounds	3100	3100	3700	3100
Deflection in inches	0.1	0.12	0.12	0.1
Brinell Hardness				
$\frac{1}{2}$-inch section	210	220	230	220
1-inch section	185	200	215	200
$1\frac{1}{2}$-inch section	170	180	195	180

Table V

Semi-Steel Mixtures

	10% S.S. per cent	25% S.S. per cent
Total carbon	3.2	3.2
Silicon	2.0	1.7
Manganese	0.7	0.6
Sulphur	0.1	0.1
Phosphorus	0.6	0.5
Ultimate strength (in lb. per sq. in.)	26,800 to 40,000	29,000 to 40,000
Transverse strength (in pounds)	2,900	3,100
Brinell Hardness		
$\frac{1}{2}$-inch section	200	215
1-inch section	180	195
$1\frac{1}{2}$-inch section	160	175

These mixtures are employed for commoner castings where service demands are less severe, and where variations in sections, etc., do not make too severe demands on their casting properties.

Present Analysis Ranges

A more recent specification (No. 5004—1927) for cast-iron, piston-ring pots, sand-cast and chilled-cast, for automobiles, specifies the analysis fully, and also standardizes the methods of taking the samples. The analysis ranges permitted are given in Table I and these same analysis limits are fixed in the later specification (4 K.6—1928) which also applies to cast iron piston ring pots.

Two other specifications give chemical limits for cast irons; namely, those for pistons and water-cooled cylinders (K.11—1919), and valve guides and air-cooled cylinders (K.12—1919). These are given briefly in Table II. Two British Engineering Standards association specifications are now in force for white heart and black heart malleable iron castings (Nos. 309 and 310 respectively—1927). These do not apply to light castings which are to be subjected to hydraulic, steam or air pressure tests, and they rely almost entirely on mechanical tests. Sulphur and phosphorus contents however are limited, and it is required that tensile test bars and bend test bars, cast and heat treated as carefully specified, shall give the minimum figures which follow:

> Bend test bars used for malleable cast iron are 8 inches long, 1 inch wide, and $\frac{3}{4}$-inch thick. The edges may be rounded to a radius not exceeding 1/16-inch, and they are tested by being bent cold, without machining, through an angle of 45 degrees or 90 degrees, as the case may be, round a radius of one inch without showing signs of cracks or flaws.

Table III gives the only British standard specifications in force for

malleable cast iron; the other relatively recent specifications (5022—1923 for Automobiles and K.17 and K.18—1925 for Aircraft Ground Equipment) having been withdrawn and canceled. Actually, the particulars in Table III are the same as in the recently canceled specifications, but for the fact that silicon and manganese maxima were also stated in the latter. Analyses, with physical and mechanical properties of the more commonly used cast irons, are given in Table IV, supplied for this purpose by an automobile and general engineering foundry, whose works are in the Midlands.

Class of Work Covered

Nos. 1 and 2 are used for automobile castings; No. 1 for lighter cylinder blocks up to 122 cubic inches capacity, and for air-cooled cylinders and general light castings, such as cover plates and small housings. No. 2 is used for heavier work. No. 3 is a nickel-chrome iron; its use up to the present has been mainly in experimental cylinders. It may be said that inquiries for suitable castings in nickel-chrome irons have increased considerably during the last twelve months.

Reports at hand on the application of nickel-chrome cast iron to air-cooled cylinder blocks, claim that the superiority of this material as regards wearing properties is marked. It is anticipated that, in due course, when the technique of their preparation and knowledge of their properties in service is further advanced, that the use of nickel-chrome cast irons will increase greatly. No. 4 mixture is used for general hydraulic work, such as large centrifugal pump bodies, and similar castings.

As is well known, the casting and other properties of cast-iron mixtures are a function of the types and grades of the pig irons used. Cheaper mixtures cannot be employed successfully for the better class work on this account. Data on typical semisteel mixtures used are given in Table V.

In general, it may be said that the demand for the better class (cylinder) irons is increasing, since the trend of design calls for castings in more complex shapes and consequently more difficult to cast soundly, with a minimum of porosity and liquid shrinkage.

This demand for better class cast iron has led to a practical application of the knowledge gained by researches on the effect of intentional additions of nickel, chromium, manganese, silicon, titanium and other elements to cast iron, which is already, in its simplest form, an almost bewilderingly complicated alloy. Three papers read at the 1929 convention of the Institute of British Foundrymen, in London, show that real progress has been made in connection with the commercialization of alloy cast iron.

Use of about 14.25 per cent silicon in acid-resisting cast iron, and of high percentages of nickel and manganese in nonmagnetic cast iron, has been well known, but the extent to which the smaller percentages of nickel and chromium now are being added to cast irons in Great Britain is not such common knowledge, as was shown in the discussion, last June, of Dr. Everest's paper, from which the first six of the analyses given in Table VI have been abstracted.

This table only contains irons with relatively low silicon contents, used to give superior mechanical properties. A famous London firm of engineers has pointed out that for thin sections, such as instrument cases, where easy machining is essential, it has found useful an iron with 3½ per cent silicon and 2 per cent of nickel. For much the same reason, 1 to 1½ per cent nickel has been added to low silicon cast irons, stabilized with chromium for heat-resisting purposes, the nickel being used to retain toughness and machinability. Similarly, some grain rolls recently have been cast with 0.5 per cent nickel added, to aid in producing a good close grain and hard surface.

Nonmagnetic cast iron which was introduced years ago under the Fɛrranti-Dawson patent, still is cast, and is being used extensively in the electrical industry in places where hysteresis and eddy current losses are objectionable. It also is cast into thin-sectioned electrical resistance grids on account of its high specific resistance in comparison with other materials, which combined with its low temperature coefficient, enables the maximum capacity to be concentrated in the minimum bulk. This material also is cast into castings many feet in diameter and many tons in weight. This alloy contains approximately 10 per cent nickel; 5 per cent manganese, and the remainder cast iron.

Have Austenitic Structure

Various other special alloy cast irons are now being cast commercially in Great Britain, by adding sufficient special elements to make the micro-structure austenitic. These austenitic cast irons are all nonmagnetic, resistant to corrosion, and resistant to deformation and oxidation in service at high temperatures.

A typical example of such austenitic cast irons contains about 20 per cent nickel and copper, added as monel metal. This possesses really remarkable resistance to certain types of corrosion, and to oxidation and growth at high temperatures. It has proved more satisfactory than brass, gun metal or cast iron, when used for the components of pumps in chemical factories.

Although it was introduced originally in America as a cheap substitute for brass, it has the wearing qualities of cast iron and approximately the same coefficient of expansion, so that it can be used in conjunction with ordinary cast iron. Its ultimate tensile strength is 20,000 to 26,800 pounds per square inch, with an elongation of 1½ to 2½ per cent, and a brinell hardness of 140. Its present use in Great Britain appears to be frequently on account of its resistance to growth and scaling at high temperatures, and it thus seems to be worthy of notice as it contains so

Table VI

Typical Analyses of Alloy Cast Irons

Compositions Per Cent							
T.C.	Si	Mn	S	P	Ni	Cr	Uses
3.35	1.6	0.8	0.12	0.25	1.0	.....	Pistons, machinable, nonporous.
3.29	1.06	0.95	0.12	0.24	1.01	.....	Uniform hardness across 6½ in.
3.27	1.21	0.88	0.22	0.21	0.75	0.25	dia. section which could not be cast in ordinary gray iron.
3.4	1.54	0.94	0.07	0.12	0.91	.....	9" square by 2" thick plate, to be pressure tight.
3.3	1.12	0.8	0.16	0.4	1.0	0.3	Casting with 6" thick sections to stand 4,000 lb./sq. in. pressure test.
3.45	1.24	0.61	0.137	0.54	1.67	0.39	Die block.
3.4	2.0	0.7	0.07	0.05	1.0	0.3	Centrifugal cast cylinder liners.
3.3	1.0	0.6	0.09	0.28	1.0	.....	Locomotive cylinders.
3.2	1.44	0.91	0.108	0.17	1.12	.....	Automobile cylinders.
3.1	0.85	0.3	0.15	0.35	1.5	0.5	Wire drawing dies, crushing machinery and chilled rolls.

much less of the expensive alloying elements than do the normal heat-resisting alloys.

Appoint Foundrymen on Advisory Committee

The state board of education has appointed H. E. Parker, superintendent of the machinery division, Peck, Stow & Wilcox Co., Southington; F. G. Hausman, factory superintendent, P. & F. Corbin Mfg. Co., New Britain; H. S. Washburn, Plainville Casting Co., Plainville; Edgar Spencer, Philbrick, Booth & Spencer, Hartford; Montague A. Clark, Meriden; P. W. Spencer, Bradley & Hubbard Mfg. Co., Meriden and Charles S. Parker, Charles Parker Co., Meriden as members of the advisory committee on foundry training in northern Connecticut. In a brief announcement in the Oct. 1 issue of THE FOUNDRY, it was stated incorrectly that F. G. Hausman was superintendent of the Peck, Stow & Wilcox Co. Mr. Hausman is factory superintendent of the P. & F. Corbin Mfg. Co., New Britain, and H. E. Parker is superintendent of the machinery division of Peck, Stow & Wilcox, Southington.

Common Errors Turn Up Constantly

By R. H. Palmer

IN A foundry in a neighboring city I was asked to watch the pouring of a casting. I stood some distance away from the mold and did not care to go nearer. They poured the casting. The cope raised.

My conductor exclaimed "That is the third one that has run out. Did you think that cope would raise?"

"Yes," I said. "When you use a cope 6 x 9 feet and 24 inches in depth, you must have quite a good sized casting in it. You cannot expect a weight of some 7500 pounds to hold it down. You see it does not do it. Of course I do not know the size or shape of the pattern."

He showed me the pattern, with a cope surface of approximately 28 square feet. Under 24-inch pouring head the casting exerted a pressure of 24,000 pounds and he expected 7500 pounds of weight plus the weight of the cope to hold the cope in place.

When molds are to be weighted prepare the mold to receive even more weight than necessary and then be sure you have weight enough.

In most jobbing foundries a bedding-in place or pit is prepared with binders in the bottom, with plates on binders at some depth, and with a cinder bed and eye bolts. The pit may be filled when not in use and floor molding performed over it.

I was called to a foundry to look at some stationary cylinders. They had lost three, weighing some 8,000 to 9,000 pounds each. I found the trouble to be at the intersection of the barrel and steam chest. The cylinders leaked at this point. Making a small hole with a narrow chisel, one could pick out graphite with a wire.

"Who mixed the iron, or gave the mixtures?"

"The chemist."

"Is he a metallurgical chemist employed by you?"

"Oh, no; he is the city chemist. In our estimation a very fine one."

"He may be a very fine sanitary chemist. I doubt his ability as a metallurgical chemist. What numbers and brands of iron are you using in these cylinders?"

He gave them.

"I have used, and am using two of the same brands," I said. "Your mixture of iron is too rich in graphitic carbon. The irons you are using are too soft. For over eight years in producing stationary engine cylinders constantly, we have lost but one and that by a corner coming off a port core. If you will use a closer iron mixture your troubles will cease as the cylinders are good otherwise according to your statement."

Yet this party was blaming the foreman who had nothing to do with mixing the iron.

In conversation with the man in charge of another foundry I asked him what percentage of sulphur he expected to gain in melting. He said he never figured the sulphur, as he did not know the sulphur content in the coke.

Different chemists allow from 0.03 to 0.05 I believe, although some technical books give the first. In my own practice while going through the yard, or on the charging stage, I adjust the figures I used according to the scent of sulphur in the air.

For some twenty years and more I have produced cylinders, gasoline, gas, and steam from 5 to 60 inches bore diameter. The foreman preceding me was told by the manager to pour the 5-inch cylinders weighing 80 pounds with the same iron he poured a cylinder weighing 7500 pounds. Then found fault with the castings. He had to throw them away because they were so hard he could not use them. Evidently, he did not have any idea the thickness of metal in a casting had anything to do with the mixture.

A firm supplied another with four gas engine cylinders. They were so soft they were cut by the packing rings. The firm was given notice to replace or stand suit. I replaced those cylinders with an iron higher in sulphur because I could not obtain an iron higher in combined carbon, using carwheels. I was then forbidden by the manager to use carwheels, as he believed in a soft cylinder. The cylinders I produced gave satisfaction and no trouble was encountered.

A softer iron may be used in a vertical cylinder than in one used **horizontally.**

Steel Founders Plan Five Year Program

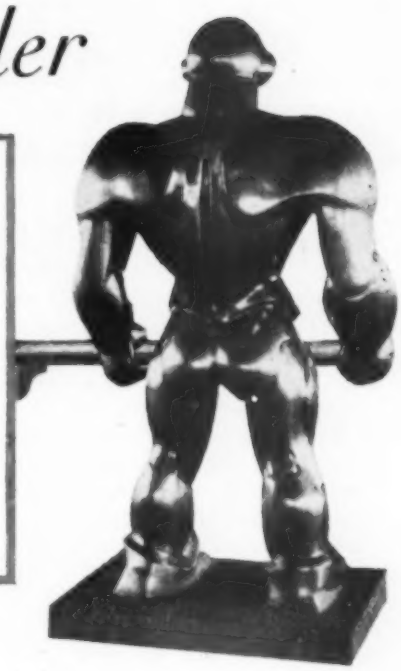
A new plan of organization and a 5-year program of activities for the Steel Founders' Society of America were approved at a meeting of the executive committee of the society at New York, Oct. 4. According to John E. McCauley, president of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. and of the society, a resume of the report as approved will be presented to the entire industry at a special open meeting in Chicago, Oct. 29.

Safety Council Names New Officers

John P. Eib, supervisor of safety and labor, Joliet works, Illinois Steel Co., Joliet, Ill., has been elected general chairman of the metals section of the National Safety council. Earl F. Blank, director of safety and welfare, Jones & Laughlin Steel Corp., Pittsburgh, has been elected vice chairman, and H. G. Hensel, safety director, Youngstown Sheet & Tube Co., Chicago, secretary.

Glorify Wrestler in Aluminum Statue

By Douglas B. Hobbs



SINCE 1892 when the sculptor, Sir Alfred Gilbert, had a statue of Eros cast in aluminum, this light metal has been used for statuary castings. Among the more recent aluminum statues may be mentioned that of Charles Martin Hall, by G. Moretti, the two gigantic sphinxes surmounting the pyramidal roof of the civil court house in St. Louis, and Dudley V. Talcott's modernistic statue of *The Wrestler*, shown in the accompanying illustration.

The life size statue of Charles Martin Hall was cast in aluminum by the Roman Bronze Co., Brooklyn, N. Y. Certainly no other metal could have been chosen appropriately for reproducing the likeness of the man who invented the first practical process for producing aluminum electrolytically. This statue occupies a place in the foyer of Severance Chemical laboratory, in Oberlin college, Oberlin, O., where Hall was a student when he received the inspiration for his great discovery.

Used Lost Wax Process

Because of the large number of small and intricate undercuts, the statue of Hall was cast by the lost wax process. The massive sphinx castings were of such a design that they could be cast in sand only through the development of certain innovations in the art. The method by which the Cleveland foundry of the United States Aluminum Co. cast the sphinxes was fully described in THE FOUNDRY, Oct. 15, 1928, under the title "Reproduces Ancient Sphinx in Aluminum Alloy." In casting *The Wrestler*, this foundry again resorted to methods which differ materially from those usually employed in sand.

The Wrestler, a broad-shouldered, powerful figure of brawn and muscle, stands 7 feet 6 inches high. As cast in aluminum with a wall thickness of ¼-inch, the statue weighed 475 pounds. The body, head and legs were cast integral. The arms and base were cast separately and joined to the main section by bolts and by welding.

Cast in Dry Sand

The main part of the statue was cast in a dry sand mold with dry sand cores. The front of the figure was cast in the drag and the back in the cope. The original plaster model was used as a pattern. The mold was made in dry sand in a suitable 2-part flask in much the same way as any mold. The sand in the cope was supported by hook gaggers. After the pattern had been drawn, and the gates and risers had been cut, the cope and drag were baked partially in a core oven.

To obtain the wall thickness of the casting, the faces of the mold in the cope and drag were lined with clay to a thickness of ¼-inch. The mold in this condition served as a core box in which the internal cores could be made, thus eliminating the item of core equipment. After fabricating the cores, the clay was removed, leaving a void which corresponded to the wall thickness desired in the casting.

The internal cores were made by ramming core sand into the open mold on top of the clay, and striking the sand off on a line with the irregular parting of the mold. The cores were supported by core prints at the shoulders and feet. One-inch stud chaplets were embedded in the drag cores to a depth of ¾-inch, and served as a further means of support. The chaplets first were placed in the mold and surrounded by clay. In making the cores, core sand carefully was packed around the part of the chaplets extending above the clay. Five undercut cores were required in the drag. These were made by packing core sand into the undercut sections. Paper was used to part the exposed surfaces of the undercut cores from the main drag core.

The cores were not removed from the cope and drag prior to baking. Instead, the entire flask was placed in a core oven, the cope and drag having been only partially baked the first time. Following this operation, the cores were removed and the clay pealed off. On replacing the cores, a void was left in the mold which corresponded to the section formerly occupied by the clay. Metal was poured through suitable gates into this cavity, forming the casting.

Makes the Arms

The right and left arms of the figure were made in a similar manner. In these castings, the hollow section of the arm at the shoulder served as a core print, while chaplets embedded in the core supported the core at the opposite end. The base was cast entirely in green sand.

A flange was cast on the main section at the shoulders and on the

arms, so that these parts could be bolted together. The feet were bolted directly to the base, and all bolted joints welded. The assembled statue was then buffed and polished to give a striking accent to the modernistic scheme of the artist who created the motif.

The aluminum-silicon alloy from which the statue of Hall, the sphinxes and the wrestler were cast has been used extensively for both interior and exterior ornamental work. This aluminum alloy, which contains 5 per cent silicon, is quite fluid at temperatures almost down to the freezing point, and has a low solidification shrinkage. This combination of properties it is claimed makes it possible to cast intricate shapes of both heavy and thin sections, and to obtain in them a sharpness and refinement of detail which is particularly pleasing. Furthermore, it is stated that accelerated weathering tests, and tests under various conditions indicate that this alloy resists atmospheric corrosion better than any of the other aluminum alloys. These properties make it excellent for that type work.

Found Process to Produce Aluminum

CHARLES M. HALL inventor of the electrolytic process by which all the commercial aluminum in the world has been produced for many years became a definite human entity instead of merely a name to the thousands of visitors who thronged the public auditorium, Cleveland, during the metal congress week Sept. 9 to 14. A life size statue of the late Mr. Hall, representing him at the age of 22 when he made his momentous discovery, occupied a prominent place in the extensive exhibit of the Aluminum Company of America. This aluminum alloy statue was made according to the lost wax process at the Roman Bronze Works, Brooklyn, N. Y. It was modeled by G. Moretti, Pittsburgh and presented to Oberlin College, Oberlin, O., by Richard B. Mellon. While a student at Oberlin in the early eighties Mr. Hall first began to speculate on the possibilities of producing aluminum commercially. On February 23, 1886 he produced the first aluminum by the new process. Progress for the first three years was slow. Then Alfred E. Hunt, Pittsburgh, took a financial interest in the venture and the foundation was laid for what eventually has emerged as the Aluminum Company of America, with headquarters in Pittsburgh and with extensive plants in various parts of the country including the one in Cleveland where the statue of the Wrestler, shown in the accompanying illustration, was made.

Celebrates Anniversary

The Verein Deutscher Eisengiessereien Giessereiverband, or Association of German Iron Foundry Owners, held its fifty-ninth annual general meeting from Sept. 4 to 7 in Dusseldorf, Dr. Siegfried Werner, president of the association, being in the chair.

This year's meeting was of outstanding interest, because the association, which claims to be the oldest union of employers in Germany, is entering upon the sixtieth year of its existence. Concurrently with the meeting the foundry exhibition opened on Sept. 4, and attracted many visitors. This exhibition was organized specially with a view to showing the progress made in economy of management in the foundries. It was both technical and commercial.

At the technical sessions four papers were presented and discussed: Prof. Thun, Darmstadt spoke on "Recent Views on the Mechanical Properties of Cast Iron"; Prof. U. Lohse, Hamburg read a report on "Tests with a Wet-Cleaning Plant"; the paper by Chief-engineer Langenohl, Gelsenkirchen was on "The Importance of the Rhenish-Westphalian Foundry Industry," while that of Chief-engineer Kuster, Cologne-Deutz dealt with "The Influence of Molding Methods on Costing."

Book Review

Business Profits and Employments Tax Manual, by Chas. H. Tolley, paper cover, 91 pages, 5¼ x 8¼ inches, published by Waterlow & Sons, Ltd., London Wall and Birchin Lane, London, and supplied by THE FOUNDRY, Cleveland, for 75 cents, and in London by the Penton Publishing Co., Ltd., 416-17, Caxton House, Westminster, for 2s 6d, postage extra.

This is a useful book for businessmen who trade in Great Britain, and is a second edition which has just been published. The new volume has been increased considerably in size and includes a section on employments and offices. It explains at length the alterations which have taken place in the system of assessments, and deals completely with the whole subject of profits derived from business. This book explains in detail what profits are or are not assessable, and what expenses will be allowed or rejected. There are a number of examples of business profits assessments, and a convenient index at the end of the book. Over 230 legal decisions are referred to and explained.

Tolley's complete income tax, supertax and surtax chart, by the same author, also just has been completed. It gives complete information in tabulated form, showing rates and allowances, synopsis of new system of assessment, examples, etc. There is a special section for foreign residents. The price of this chart is 85 cents, or 3s in Great Britain.

Joseph W. Eshelman has been appointed representative in the Birmingham, Ala., district for the Pennsylvania Pump & Compressor Co., Easton, Pa. Mr. Eshelman's address will be American Traders Bank building, Birmingham, Ala.

CREATING *Good Will* for Castings

CAST-IRON WORK AGAIN BIDS FOR FAVOR

Charming Examples of an Old Art Are Still To Be Found, Notably In the City of Mobile

Reproduction of Article in the Magazine Section of the New York Times which describes the Beautiful Cast Iron Decorations Found in the City of Mobile

DECORATIVE cast iron again is coming into popular favor. An old art which flourished in the middle of the nineteenth country, is being revived to provide distinctive decorations for modern architecture. The trend toward cast gray iron has been described by several writers. Two articles by Edwin Bremer entitled "Grace and Artistry Portrayed in Cast Iron," appeared in THE FOUNDRY, March 1 and 15, 1928. An article by Olive Brooks in the *New York Times Magazine*, Sept. 8, 1929, gives interesting information on the use of cast iron decorations in Mobile. The article in part is reproduced through the courtesy of the *New York Times*:

Today most builders look on decorative cast iron as a degenerate medium ousted from favor by the post-Victorian reversal of taste that followed its unrestrained use. In the preceding period rusty fawns, gilded lions and whitewashed rabbits vainly strove for a sylvan naturalism in parks and on private lawns. But the recent interest displayed in the better examples of cast design suggests that we may be on the verge of a revival similar to the modern re-establishment of wrought iron in the artistic scheme.

Castings may not achieve the light and graceful lines obtainable by the hand-fashioning of easily bent strips and scrolls. They have, however, superior strength and durability for many purposes and lend themselves to relief work and three-dimensional patterns.

Possibly in no other American city is there as much interesting cast iron as still remains in Mobile, where it enjoyed a wide popularity from the late 1840s until about 1870 and now lends a mysterious aspect to the brick houses characteristic of the time. Often the designs are so interlaced with the wisteria that drapes the galleries in clusters of purple blossom, or the lush growth of Mexican coral vine covering the iron with a network of rose-colored flower chains, that only the corner of a balustrade is clearly visible. The patterns of other balconies stand out in sharp silhouette against walls or sky.

Many types of design may be noted, including the purely naturalistic, which were often the original conceptions of local artists, and the more conventional patterns inspired by the Gothic, Grecian and rococo revivals of the nineteenth century. Some of these also are to be found in the contemporary iron work of other sections of the country. Because of the type of buildings on which they are used in Mobile, the soft quality of the light tones, and the background of luxuriant trees and shrubs against which they are usually found, even the formal patterns are freed from the suggestion of stiffness from which cast iron may suffer in a different setting, and here they seem a peculiarly happy note in the local architecture.

It is likely, however, that the city may not long retain that unique atmosphere in which its cast iron plays such a large part. For the owner of almost any tall brick house of antebellum days has more than once been called to her door by a gentleman desiring to purchase the front gate or the entire fence, and failing in this, at least insisting on the purchase of the little side balcony. To most Mobilians this dismantling of their premises would constitute a virtual family dishonor, not to be lived down, and the collector must go away unsatisfied. But if he has been sufficiently apologetic for mentioning a sale, the owner may tell him the story of her house and its iron—whether her great-grandfather built it and had the gallery railing designed from the flowers in his own garden or if he bought it just as it was from Cousin So-and-so who had lost everything in a lottery. On the other hand, at some neighboring residence where a 'Furnished Room' sign hangs in the window, the family for whom the house was built has probably been long forgotten and the owner is more likely to consider an offer.

Historically, the love of decorative iron goes back into Mobile's Colonial days, for the city was settled by the French and had been a Spanish possession for thirty years before its occupation by the United States during the War of 1812. Thus to the Frenchman's taste for the ornate had been added the Spaniard's well-known skill in metals. Most of the former population remained after the change of government, and the incoming American settlers were soon amal-

gamated with the natives, adopting many local ideas and habits of construction.

Along the narrow Latin streets is found an astonishing variety—not only in the detail of iron trim, but in the forms and sizes of the galleries. The earliest houses, which stand flush with the property line, show the strongest French influence. If the galleries are narrow, they are supported by brackets; if wide, by round iron uprights set at the outer edge of the sidewalk. Thus, these wider galleries also serve as a marquee. Pendant from the floor of the gallery itself there is usually a narrow design of iron edging that harmonizes in pattern with the balustrade. Above, the galleries vary from the modest single uncovered floor to double porches shaded by an ornate canopy.

The elaborate structures of the 1850s reflect the increasing American influence. These houses are set back about ten feet from the property line and often have a projecting wing, outside front steps and a tiny yard space. Across the front of such houses there is usually a full two-story gallery supported by trellises and often there are small galleries or window balconies on the front of the wing.

For many of the finer residences the iron work was specially designed. All of the castings were made at one time and the duplication was not permitted. The majority of house-owners, however, seems to have made small effort to match or harmonize the fences and galleries, much less to consider those on the neighboring properties. A balustrade in faithful reproduction of acorns and oak leaves is perhaps enclosed by a fence of Gothic inspiration, and the gate may be equipped with a china doorknob. Yet the naive assortment is wholly charming.

Most of the iron is repainted at intervals. Many owners do not confine themselves to a protective coat of black or dark green, but boldly refurbish their galleries and fences in ivory or pure white. Oddly enough, the effect is entirely satisfying and lends a happy note of contrast and lightness to the subdued tones of the narrow streets where the dense foliage of tall live oaks casts an almost unbroken shadow along the weathered brick of the old homes. Architects have deplored the painting of the iron work, since it hides the texture and blurs the sharpness of the workmanship.

In the late 1840s scientific advances made the casting process much cheaper and easier than formerly and that medium came into popular use. At first it was employed only to accent the wrought product—a button or rosette of cast metal being added to mark the joining or crossing of wrought strips or scrolls. Later the two forms were combined in various ways until finally the castings (which, of course, could be turned out in larger quantity once the initial pattern was completed) almost displaced the use of the wrought variety.

The earliest castings were done in imitation of wrought designs, but the manufacturers soon realized the possibilities of the newer medium and began to produce individual effects. One rather grotesque gallery has a balustrade, trellis and canopy-trim in a continuous pattern of interlacing sticks and switches each about two feet long. Clusters of grapes with natural leaves and tendrils often recur and are sometimes combined with the conventionalized honeysuckle and acanthus ornament. Morning glories seem to have been the inspiration for a unique trellis, and one of the most frequent balustrade patterns resolves into central motif of roses.

Tons and tons of iron of beautiful workmanship were sold for scrap and carted away to the furnaces in an attempt to modernize Mobile before the worth of the old iron began to be appreciated. This was particularly true of the massive fences enclosing parks and public buildings. Perhaps the most interesting of these larger fences is the one which surrounds the entire square occupied by the Cathedral of the Immaculate Conception.

Wins Safety Award

Pettibone Mulliken Co., Chicago, now is setting out to make a new mark in the prevention of accidents, after having won the inter-plant contest of the Chicago Safety council for the best record in July. For 45 days from July 1, the company did not have a lost time accident. When it is considered that the concern employs 850 men in hazardous work, the record is regarded in Chicago industrial circles as unusual. The company has its own physician, Dr. J. T. Degan, and carries its own casualty risk. By assuming this risk the company has cut its cost of insurance from $36,000 to $11,000 yearly. A central safety committee watches safety in the plant. It is composed of the operating manager, Dr. Degan, and the superintendents of the various departments. This group holds regular monthly meetings at which problems are discussed and plans mapped out for cutting the accident rate. Each month the committee appoints from a different department some man to act as inspector. This employe devotes a portion of each day to a tour of the plant, inspecting safety devices, noting whether the men are taking all precautions against injury and making such recommendations for changes and improvements as he deems necessary.

Describes Electric Type Molding Machines

Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland, recently has issued a bulletin on its jolt, rollover, pattern draw molding machines operated electrically. These machines have an air jolt. The first portion of the bulletin is devoted to a discussion of the advantages of that type machine and to views showing the old and new methods of installation. The next section contains a description of the sequence of operations, general assembly views and design, construction and operation of that type machine. The last section is devoted to the detailed specifications and dimensions of the machines and to several views of typical installations. A time study of the operation of the Osborn electric type molding machine also is included in the last section.

Foundries Plan Merger

Wisconsin Malleable Iron Co., 94 South Bay street, Milwaukee, and Lakeside Malleable Castings Co., Twenty-third and Clark streets, Racine, Wis., are negotiating for a merger. The Milwaukee foundry was badly damaged by a fire several weeks ago, and instead of replacing structures and equipment, consolidation of operations is contemplated, where sufficient capacity is available in the Lakeside plant. According to William V. Osborne, president and general manager of the Lakeside company, it will require several weeks' time to complete and approve the plan of merger. W. H. Osborne is president of the Milwaukee company, which he assisted in organizing about 50 years ago. The foundry employed about 150 men, all of whom would be given employment at Racine.

Dr. Bernard Hague, principal lecturer in electrical engineering at the University of Glasgow, Scotland, has accepted the invitation to serve as visiting professor of electrical engineering at the Polytechnic Institute of Brooklyn, Brooklyn, N. Y., for the present academic year.

Brass Shop Solves Four Problems

Nonferrous Foundry Finds Methods To Overcome Difficulties Arising in the Production of Various Types of Castings

By H. T. Roast

OUR brass foundries melt two to three hundred thousand pounds of bronze a month, pouring it in to castings varying from possibly 5 to 10 pounds up to 5000 pounds. In addition to that, bronze is melted for architectural purposes, some fine light work and some larger work.

In this discussion, which will deal with some of the problems encountered in our foundries, four examples will be cited. One example is in connection with the question of separation in a phosphor-bronze alloy upon fracture. Another deals with white metal alloys for architectural work, which the brass foundryman may be called upon to pour in sand. Another touches upon elementary metallurgy in the making of a simple buttonhook, which brings out general foundry principles. The fourth features the casting of a bronze door, in size about 4 feet by 13 feet, and ¼-in thick.

Figures Do Not Agree

The first problem relates to the separation upon fracture of a phosphor-bronze alloy. The alloy contains 11 per cent tin, and three-quarters of 1 per cent phosphorus, by analysis after cast, and the balance copper. This example is cited because foundrymen may lose castings because specifications are not met. It is not always the foundryman's fault that his castings apparently do not meet the specifications. In case in question the first trouble arose when we were told by the customer's chemist that the phosphorus content was 0.56 instead of 0.7 per cent. We sent out samples for check analyses and received a variety of test results. In connection with these differences, after finally running each one down as far as possible we got an agreement on a figure of 0.7 per cent, which was the figure originally put out by the laboratory of our own foundry. That cleared up the difficulty found in the analysis.

We also had the brinell figure to contend with. This was supposed to be 70 brinell on the machined casting. We are all familiar with the brinell tests, and the author does not wish in any way to suggest that the brinell is not a satisfactory test, because it is. However, attention should be drawn to troubles of the foundryman when he meets with tests made on brinell machines that may not be kept in the order in which the original maker intended. In this instance, we had a brinell figure of something like 48 for the lowest and around 57 for the highest, made, not by the chemist, but the engineer of the customer. Our own figure was around 70 or 72. We sent the bar to various firms and received a variety of results.

We then made a bar consisting of 8 per cent tin and the balance copper, with little phosphorus for purposes of deoxidization and not sufficient to form a phosphor-tin compound. An attempt was made to get a uniform bar. This bar gave 45,000 pounds in strength, 22,000 pounds in yield point, and 56 per cent elongation. It was thought that these figures indicated a sound metal. We found that when we sent these bars to the various brinell testers, we got uniform results with the exception of our customer. We then secured a standard steel bar with a brinell about 310 and sent that out to the same group. We all agreed, including the customer. It would therefore appear that there was something peculiar about the test made on the customer's brinell machine that had to do with soft metals and which did not show up on hard metals.

Separate in Layers

Perhaps the most interesting problem from the metallurgical point of view is that of separation. In this case certain bearings were about 8 inches long and ⅝ inch thick, and about 5 or 6 inches in diameter. The bearings were given a fracture test. When these bearings broke, two layers, with the dividing line practically in the center of the cross section, opened up almost sufficiently to cause the casting to fall into two pieces. The questions of general oxidation, of impurities, etc., all suggested themselves to the foundryman and an investigation was started.

While the investigation in the foundry was going on, samples were taken for macrographic and microscopic examination. The author does not agree with the practical man who sometimes thinks that the microscope is an unnecessary addition to the foundry. However, that instrument has been abused. Too many micrographs are put out that are pictures and have

Trouble Hunting

EVERY now and then a nonferrous foundryman will encounter trouble in various phases of the shop practice, including the molding, core making and melting departments. At such times, the experiences of other foundrymen working along similar lines are welcome and often point to the source of the trouble. In this article, which is abstracted from a discussion presented at the Chicago meeting of the American Foundrymen, the author gives the practical solutions to four problems which developed in the every day practice at a foundry specializing in bronze castings. The author is metallurgist, National Bronze Co., Ltd., Montreal, Que.

little practical history. In this instance macrographs were taken at ten diameters. These often tell much more than the high powered micrographs. We also discovered that there was a standard bearing of the type involved in this discussion made in Europe. On taking the European standard, we found that the metal part was not entirely sound, in fact, far from that. It did not separate on fracture but it did have a considerable number of voids and a large dendritic structure. We cast our own bearings at temperatures of 2100 to 1900 degrees Fahr., respectively. That is to say, we started pouring with a pot of metal at 2100 degrees and then continued pouring these castings to 1900 degrees. We then broke one bearing out of each flask and found that until we reached 1900, the separation was marked and distinct. When we cast below 1900, the cross section was uniform and the metal entirely sound.

Explained by Macrographs

The reason for this result was explained by the macrographs. These showed a large dendritic structure when poured at 2100, at 2000, and near 1900 degrees Fahr., the dendritic structure naturally getting somewhat smaller. These large dendrites fitted loosely. When the two chilled surfaces of the bearing solidified, they fed on the loose dendritic structure and actually pulled apart until finally they separated. The two layers were due entirely to an incorrect pouring temperature.

We have found with our larger customers that if once a year or once in two years we get a problem of that kind and tackle it in a more or less thorough manner and then mail them a report with the photographs and other data, it helps our business and seems to establish a feeling of confidence on the part of the user.

The final outcome of this investigation has been that the product made in Canada has been preferred to that made in Europe, because of its obviously greater soundness.

Now turn to another problem, the question of a white bronze needed for a rather peculiar situation. One of the features was a mirror requiring the Adam period decoration in metal, the metal to be of such a nature that it practically could be pressed down by the thumb to make perfect contact with the contour of the mirror. We were given an alloy containing 5½ per cent copper, 8 per cent aluminum, and 2 per cent tin, the balance zinc, as being that already in use. The difficulty with that alloy is its extreme brittleness. It was found that the molding had cracked by the time a screw had seated firmly.

We then went to the other extreme in pure lead. We got satisfactory castings in green sand and all the fine contours were easily followed. However, for all but the parts actually lying on the mirror the lead was too ductile.

We then tried linotype metal, feeling that it was too brittle, and it proved so to be. We then mixed linotype metal, which is essentially 12 per cent antimony and 6 per cent tin, with an equal quantity of lead and still had too much antimony. Then we tried 25 per cent tin, the balance lead, a low solder. That was satisfactory. We knew the physical qualities would be satisfactory, but we doubted if we would get good castings in sand. However, they turned out to be quite satisfactory.

A part of this work was a diagonal grill, of which the outer faces of the diamonds in the grill were polished, leaving every other diamond, which was sunk below, in relief. We finally reached an alloy of 50-50 solder with 2 per cent of antimony, which gave us the necessary rigidity with sufficient bendability. That word is used intentionally, because it has been found the bending of some of these alloys is not a direct measure of their ductility. It has a relation but it is not a direct one and the two terms are not quite synonymous.

Casting a Buttonhook

We have the simple proposition of making a buttonhook and shoe horn combined. The hook is made of a nonferrous metal which must have the strength or a reasonable approach to the strength of steel. In making the casting, numerous problems were encountered.

The metal chosen naturally would be one of the manganese or aluminum bronzes. We selected manganese bronze. At first the mold was made and cast by being gated on the shoe horn end, and tilted and run upward. Many, of course, will remark, "Well, of course, we knew that was wrong." Everything ran nicely but the last part of the hook, the part which should have been strengthened, was more like a cold shut with a central pipe.

It was a simple matter to reverse the operation, cast with the hook end downward and add a piece of metal that would provide a perfect run at the end. That was all right so far as the end was concerned, but when making a bending test, it was found that the fracture would occur in the center, with that characteristic shrinking effect of manganese bronze, shown by yellow spots and yellow porosity.

It was decided that perhaps this central portion was too thick, so the pattern was whittled down and an attempt was made to get a more uniform flow. Still pouring from the end and in this position it was not possible to get more than about one-half an arc in the bending. Since shrinking was evident, the casting had to be fed more. It was gated from the middle and two inches from the center and good castings were secured. Placing the casting in a vise it was possible to bring the points of the shoe horn, one over on the other, and the ends would spread apart as good manganese bronze should when released.

Pouring a Bronze Door

Makers of architectural bronze may be interested in the history of a door about 13 feet high, 3 feet 6 inhes broad, and only to be ¼ inch thick. The door had large panels in it. The pattern for the door was built on a board, all panels and moldings being loose. The pattern consisted of five panels 26 inches square, with floral design borders on each side and plain strips between. The panels were cast in aluminum from a white metal master pattern, which, in its turn, was made from a plaster pattern. The balance of the floral design was partly in wood with wax design on the wood, and some of the main divisions surrounding the panel were in brass. Brass, wax, wood, and aluminum all were used in the one pattern.

The pattern was put in the hands of a man who evidently was not familiar with the job. When he drew the pattern he drew most of the sand with it. However, that trouble was overcome.

The flask in which this casting was made was as follows: 15 feet long, 5 feet inside and 14 inches total depth, cope and drag being of equal thickness. The flask was cast iron having a metal thickness of ½-inch. Apropos of that, we would advise at least a ¾-inch cross section, but we were limited in the crane handling capacity where we had to make the casting and were trying to cut down the weight. We would probably have had little better result had we made the flask more rigid.

The drag half of the flask had a grill on the bottom and five spacer rods to prevent spring. These rods were 1 inch in diameter with locknuts inside and outside. The cope half of the box had cast iron bars spaced every 7 inches. These bars were made to conform to the shape of the door, leaving 1-inch clearance for the sand. The sand used for

facing was new French molding sand milled 24 hours previously to allow the moisture to become distributed uniformly.

Twelve days were required from starting the assembly of the box to the finish of the casting. Two molders were employed, with one helper. Two and one-half days of that time was taken in drying the mold in the oven. The molds were dried in a flat position, the drag half on the bottom and the cope above the drag supported on legs about two feet long. This was done to avoid as much as possible the moisture from the lower half distributing the sand in the upper left half. If we had had the facilities, we would have preferred to have dried the box on edge, as we do with our smaller French sand work.

Diminish Cracks in Mold

The question of cracking caused considerable worry. Every time we handled the box, we had a fear that further cracks would start. We endeavored to locate the cracks along the panels by making separations, and were rather successful in that the cracks did follow more or less the lines suggested. We could not fill the cracks that occurred in the mold, as probably all who have done that work will know. Sand expands when heated and forces the filling outward. This leaves a hole or an indentation in the casting.

The mold was poured from five reservoirs since we believe in the reservoir form of pouring. The plugs in the reservoirs were two inches in diameter, with sprues leading to the runners and gates leading from the sprues directly into the center of each panel. We fed in from the back of the casting, the mold being tilted 2 inches to the foot. The runner was at the back, the five reservoirs were lined up in equal spaces and the runners went down right across the plate. In addition to that, separate runners ran directly into each of the five panels. This arrangement produced a satisfactory casting. We arranged to have enough metal left in the reservoirs so the last surface metal, with its skin and dross, did not run in at the end and spoil the casting. The size of the gates was 2 inches by 1¼ inches thick leading from the runner and 2 inches by ¼ inch leading from the runner into the mold.

Due to the large superficial area of these doors, great precaution was necessary to prevent straining while being poured. To this end, after the cope and drag halves of the mold were closed, perforated steel plates were placed all along the cope surface, with three ordinary rails running the full length of the mold. Five channel irons were placed at right angles to the rails, with both ends protruding over the sides of the box. These irons were fastened down by long bolts.

The next point of interest probably is the kind of metal used. This door had to match a framework of extruded metal, and ordinarily a formula of 16 per cent zinc, 3 per cent tin, with possibly up to one-half of 1 per cent lead and the balance copper would have been used. It was thought that this metal would not be satisfactory because of the thinness of the casting and the possibility of more dross being in the metal. The mixture was changed to contain 10 per cent zinc, the balance of the alloy being much the same. The color of that alloy was quite satisfactory.

The metal was melted partly in an electric furnace of the arc type and partly in crucible furnaces. This work happened to have been done in one of our foundries in which we use the crucible type of furnace in place of all electric. The metal was taken out of the furnaces at 2350 degrees Fahr., tested by the pyrometer. It was poured at about 2150 degrees Fahr. This procedure resulted in a casting which had no obvious flaws on the whole of the surface.

Battelle Institute Staff Is Being Organized

Battelle Memorial Institute, Columbus, O., nearing completion on West King avenue, conceived and made possible by the late Gordon Battelle as a memorial to his father, Col. John G. Battelle, for the promotion of research in metallurgy and fuels, will soon be opened. Under the directorship of Dr. H. W. Gillette, formerly chief metallurgist of the bureau of standards, the nucleus of the staff has been selected, which later will be increased to 20 specialists. Dr. H. W. Russell, formerly of the Carnegie Institute of Technology, is chief physicist. W. A. Welcker, formerly associated with the Norfolk & Western railroad at Roanoke, Va., is mechanical engineer. C. E. Irion is in charge of technical supplies and equipment. G. B. Fenton is business manager. Dr. Marjorie Benoy is analytical chemist. Miss Thelma Reinberg is librarian.

F. E. Fisher, formerly connected with the Chicago office of the Bethlehem Steel Co., Bethlehem, Pa., has been transferred to the main office at Bethlehem. He will work in the Eastern district as foundry advisor.

Describes Supervision of Plant Health

National Safety council, 108 East Ohio street, Chicago, has published its health pamphlet No. 5, dealing with health supervision in industry. The folder stresses the benefits to be derived from a good plant health service. Treatment of injuries and sickness, prevention of sickness, procedure in case of employes having communicable diseases, sanitation, physical examinations and dental and eye service are discussed. Employes benefit associations also are mentioned. Considerable space is devoted to the qualifications of the personnel of the plant health service. Specifications for the dispensary and methods for securing cooperation of the management and the employes receives comment. The bulletin may be obtained by addressing the National Safety council, 108 East Ohio street, Chicago.

Catalog Contains Data

James B. Clow & Sons, Chicago, and the National Cast Iron Pipe Co., Birmingham, Ala., recently have published the eighth edition of the catalog of their products. The book contains general information on cast iron pipe and many specifications for various sizes of pipes, sleeves, bends, tees, crosses, etc. The catalog also includes the American Water Works association standard specifications for cast iron bell and spigot pipe and fittings, American standard for cast iron flanges and flange fittings and the American Gas Association standards for cast iron bell and spigot pipe and fittings and cast iron flanged pipe and fittings. Sewage disposal equipment, various type valves, chain wheels, fire hydrants, etc., also are described.

Unite Under Sales Plan

Hibbard S. Greene, formerly vice president and director of the Barber-Green Co., Aurora, Ill., has been appointed asistant to the president of Chain Belt Co., Chicago. Mr. Greene will co-ordinate the marketing plans of the Chain Belt Co., Sivyer Steel Casting Co., Federal Malleable Co. and the Interstate Drop Forge Co., all of Milwaukee, as well as the Stearns Conveyor Co., Cleveland, the latter company being a division of the Chain Belt Co. The same financial interests control the above four companies. A wide range of products will be covered in the plan. Mr. Greene's headquarters will be at the Milwaukee plant of the Chain Belt Co.

Questions & Answers on FOUNDRY PRACTICE

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall—Cast Steel
H. A. Schwartz—Malleable Cast Iron
J. W. Bolton—Gray Cast Iron

All questions should be addressed to The Editor, The Foundry, Penton Building, Cleveland.

MALLEABLE

Spots May Be Shrinkage

QUESTION

We are sending you two broken castings of a small elbow and a union which you will notice contain dark spots on the fractured surface. Are these spots caused by shrinkage or by the cores? The patterns are mounted on plates and have good sized feeders. The analysis of the white iron is as follows: Silicon, 0.91 per cent; sulphur, 0.07 per cent; manganese, 0.31 per cent, and total carbon, 2.98 per cent. The iron is melted in a hand-fired furnace and the charge is made up approximately of 53 per cent pig iron, 38 per cent sprues, 6 per cent annealed scrap, and 3 per cent steel rails. Core materials used are Michigan City sand, linseed and fuel oil, and proprietary corn flour binders. What iron analysis do you recommend as most suitable for malleable steam pipe fittings?

ANSWER

We cannot tell by inspection with certainty but consider that the spots are most likely shrinkage. This might be checked by using the softest possible rosin cores. Pipe fittings frequently are made from cupola iron which usually contains high sulphur around 0.10 to 0.15 per cent and a correspondingly high manganese to match. This iron will contain about 3.0 per cent carbon. The analysis you give should be satisfactory but sometimes more silicon may be permissible in such small castings.

STEEL

Nails Cause Blows

QUESTION

Recently we have had considerable trouble from blows caused by nails used for chilling bosses. On one particular job, a hub of which we have made several hundred, we suddenly run into blows in the bosses that are nail chilled, and apparently there is no reason as the job is made exactly as it was before. It appears to us as though the atmospheric conditions have something to do with it, or it may be in the nails although we have purchased our nails from the same firm for many years. Is there any coating or treatment of nails that will prevent moisture blows?

ANSWER

Generally there are only two possible causes of the trouble that you refer to, and they are rusty nails or wet nails caused by condensation of moisture from the sand. It is possible that when the molders are in a hurry to put up the molds, they grab a handful of nails and insert them without noticing whether they are rusty or not. Nails will rust if they are allowed to stand open in the foundry day after day. The best way is to keep them in a dry place, and see that nails not used are returned to storage.

Another fruitful cause of blows from chill nails is the condensed moisture which collects when the molds are allowed to stand for long periods before pouring. This condition is aggravated considerably if the sand is hot and steamy, and in such cases moisture rapidly condenses even in a relatively short period. Some foundries use copper plated nails which are claimed to resist rust. You might try some of the methods used in gray iron foundries for coating chills or inserts. Sodium silicate, oil, red lead, shellac, etc., are used to coat the chills which are dried thoroughly before use.

GENERAL

Uses Permanent Molds

QUESTION

We are interested in the manufacture of cast iron balls to be used in mills for grinding gold-bearing quartz. Can you give us the name of any firm which makes permanent molds in which these castings are poured. We also should like to know the most suitable analysis for these castings in sizes from 1 to 4 inches diameter and the proper precautions to observe to prevent shrink spots on the surface.

ANSWER

So far as our knowledge extends no firm is engaged in the manufacture of permanent molds for the production of cast iron balls. The only molds of this kind that are made have been developed for their own use by firms engaged in the production of balls. In the most elaborate installation of this character with which we are familiar a battery of molds set up in a double row has a capacity of 20 tons of balls a day. Each unit in the battery is made up of two large slabs of cast iron corresponding to the two halves of an ordinary sand mold. However, instead of being mounted one on top of the other in the usual horizontal position, the two slabs are set up vertically. One half is stationary and the other half is drawn back and forth by a hydraulic plunger. The mold cavities are arranged in a double row with a central runner and suitable gates in the opposing faces of the two slabs. After the castings have set the mold is opened and the balls fall on a conveyor which drops them into a railroad car. The runners are removed by an attendant while the castings are on the conveyor.

In smaller installations the same general design prevails with the exception that the molds are operated

by hand. Provided your potential market warrants the expense we have no doubt your company could make a set of molds to meet your conditions. If the castings are poured with a high head and through a small runner they will show no sign of shrinkage on the outside. Since extreme hardness is the only requisite of these castings they may be poured from any available mixture of white iron.

Q & A

Castings Are Too Hard

QUESTION

We make gray iron castings ranging in thickness between ⅛ and ½ inch and the machine shop complains that the thin castings are too hard to machine. The cupola mixture is made up in 1000-pound charges of the following composition: 100 pounds pig iron, silicon 2.20 per cent, sulphur 0.03 per cent, phosphorus 0.15 to 0.22 per cent, manganese 0.30 to 0.80 per cent; 300 pounds pig iron silicon 3.20 per cent, sulphur 0.03 per cent, phosphorus 0.57 per cent, manganese 0.96 per cent; returns and light scrap 500 pounds and steel 100 pounds.

ANSWER

Assuming that the scrap carried a silicon content of 2.50 per cent, a generous estimate, it is apparent that the silicon content in the iron as tapped from the cupola is only about 2.20 per cent. This is quite satisfactory for the heavier sectioned castings, but is too low for castings ⅛-inch in thickness that have to be machined. The obvious remedy is to raise the silicon in the iron destined for the light castings. This may be accomplished in any one of several ways depending on local conditions. You may omit the steel from certain charges, or, you may add ferrosilicon to the iron either in the cupola or in the ladle. You may increase the quantity of high silicon pig iron and decrease one or more of the other components to a similar extent. Where only a small quantity of the castings are affected, a cure may be effected by adding a small quantity of nickel to the ladle.

Q & A

One Cupola Sufficient

QUESTION

We are casting about 33 tons of iron a day into light castings and melt the iron in two cupolas, one 70 inches inside diameter and the other 48 inches diameter. We get the first iron at 3 p.m. and the bottom is dropped at 4:15 p.m. Does this represent good cupola practice or do you think we should do better? How does it compare with the usual practice in stoveplate foundries? Is it customary in these shops to run a continual stream or is the metal tapped at intervals?

ANSWER

With good coke and iron and under normal working conditions a cupola lined to 70 inches will melt 18 tons an hour. Under the same conditions a 48-inch cupola will melt 9 tons an hour. The combined melting capacity of the two cupolas is 27 tons an hour. This means that in your case you should melt 33 tons in approximately 1¼ hours. Unless you need the two cupolas for distribution of the iron you would find it more economical to melt the entire heat in the large cupola which should run the metal down in approximately 1¾ hours.

Practically all stoveplate shops are operated in accordance with the terms that have been adopted by associations representing the shop owners and the molders. These agreements provide a definite number of hours to be devoted to molding, also a definite number set aside for pouring off and shaking out. Melting units are installed of sufficient capacity to melt the required amount of metal in that section of the afternoon set apart for the purpose. The usual practice is to run a continual stream, but where monorail systems have been installed, the metal is conveyed in bull ladles to various points on the floor and there transferred to hand ladles.

Q & A

Needs Close-grained Iron

QUESTION

We have several oval pipes to make 3¾ x 12 inches, 9 feet in length and with a wall thickness of ¾-inch. We are going to mold these in green sand horizontally with the wide diameter of the casting on a plane with the parting in the flask. In service these castings will be held at a cherry red heat all the time. We shall appreciate your advice on a suitable mixture that will give maximum service under the foregoing conditions.

ANSWER

A suitable mixture may be made up from various combinations in which steel scrap and malleable pig iron figure prominently. Iron to conform to the following analysis will give satisfaction: Silicon, 1.50 per cent; sulphur, 0.05 per cent; phosphorus, 0.20 per cent; manganese, 0.80 per cent; total carbon, 3.00 per cent.

Although you do not inquire about molding methods, you may be interested to learn that where these castings for sugar making installations are made in large quantities, they are molded and cast on end. The principal reason for this practice is to insure a maximum metal thickness in the casting. The method in which you propose to mold the casting is hazardous in that the core is apt to spring in the center and thus form a thin and a thick side on the casting. Uneven thickness will cause the casting to warp and crack and is responsible for more lost castings of this type than unsatisfactory iron. You will need one chaplet on the bottom in the center and two on top, besides studs on the core prints. The most careful workmanship is required in anchoring the cores properly.

Q & A

Ring Core Will Chill

QUESTION

We are confronted with a proposition of making a casting with a chilled surface. We do not care to use a split chill and we cannot use a solid chill on account of the shape of the casting. Is there some substance we could mix with sand to form a ring core that will take the place of the usual chill?

ANSWER

We know of no material or method except a one-piece chill that will chill the iron on the face of a wheel and at the same time produce a clean, smooth, uniform surface. We presume your objection to the use of a split chill is on account of the seam at the two opposite joints which will show on the face of the wheel. Another objection might be that where split chills are used over an extended period of time, they become what is known in the foundry as *out of round*. In other words they no longer form a true circle when assembled and of course the casting is distorted to a similar extent. Where the face of the wheel is machined before it is placed in service, this inequality is not a serious factor, but where the wheels are not machined on the face, this feature naturally will condemn them.

If it is feasible in your case to finish the chilled surface of the wheel by a slight grinding operation, we suggest you use a great number of chill segments instead of the usual two or three. You will get the same chilling effect, the pieces readily may be placed in the core print provided for the purpose and they are removed easily from the casting in the shaking out process. The face of each chill piece that comes into contact with the casting may vary from ¼-inch to 1-inch in the case of fairly small wheels. Where larger castings are involved, the face of each chill piece may be made slightly concave to conform to the circumference of the wheel and therefore may be several inches in width.

With the possibility that you may be able to adapt the idea in some manner you may be interested to

know that iron chips from the machine shop frequently are mixed with the facing sand for gear wheel teeth. This treatment does not chill the working faces of the teeth, but it produces a closer grain in the iron than otherwise would be obtained. Some time ago a foreign foundry paper contained a description of a patented method by which a foundryman mixed steel shot with his core sand to obtain the same result in certain parts of his castings.

Q & A

Leak Under Pressure

QUESTION

We are having trouble with a water jacket for a tank heater which apparently is a good casting until it is tested under water pressure. Upon breaking the casting we find dirty areas at the points where the water leaks through. We melt the best grade of iron in our cupola and are at a loss to account for the dirt in the castings.

ANSWER

Your trouble is not due to the iron but may be traced either to the mold or the core or perhaps to both. In rare instances slag floats in with the iron and causes trouble, but under ordinary conditions where the iron is melted and poured hot all the impurities rise to the surface and are skimmed off before the metal is poured. Usually a pinch of sand sprinkled over the metal in the ladle will form a skin to hold the impurities in place while the metal flows over the lip.

The most probable cause of the trouble is the core. It is practically surrounded by iron and unless the vent is released freely and rapidly through the natural openings provided for the purpose, some of the gas will seep through the surface of the core and cause the metal to boil at that point. This violent action of the metal in a thin section together with a small quantity of sand or blacking which it scrapes from the surface of the mold and core results in a porous area which is revealed when the water pressure is applied. Use exclusively a fairly coarse grain sharp sand bonded with a minimum amount of linseed oil, place generous vent passages in the core, see that the openings in the core prints are clear and you should have no further trouble with leaking castings.

There is a possibility that a slight amount of dirt may have been washed in from the runner or gate. We suggest you check up on a few molds before they are poured to satisfy your mind on this point. Examine the runner and gate after the casting has been shaken out and if rough spots are visible it is apparent that the sand from these spots has been carried along with the stream of iron.

GRAY IRON

Grate Bar Mixtures

QUESTION

There seems to be considerable controversy over the best mixture for grate bars and other boiler room equipment subject to great heat. Since this type of equipment is a large part of our production, we will appreciate some information on the subject.

ANSWER

The thing to guard against in iron subjected to high temperatures is growth of the castings. Growth is believed to be caused first by the destruction of graphite and then by oxidation. To reduce the tendency to grow, the graphite must be kept as low as possible. For grate bars we suggest two analyses, one of medium silicon content, and the other low. Each of these analyses has its advocates who claim excellent results for the product. The medium silicon content has the following range: Silicon, 1.50 to 1.75 per cent; sulphur, 0.10 to 0.12 per cent; manganese, 0.50 per cent, and phosphorus, 0.20 to 0.50 per cent. The analysis with the low silicon content contains: Silicon, 0.8 to 0.9 per cent; sulphur, 0.20 to 0.25 per cent; manganese, 0.20 to 0.30 per cent, and phosphorus, 0.30 per cent. You might try adding 0.95 per cent nickel and 0.50 per cent chromium to a mixture where the silicon runs about 1.10 per cent. The low silicon, high sulphur iron should be annealed at 900 degrees Fahr. to remove any strains.

Q & A

Uses Steel In Mixture

QUESTION

We want to use steel scrap in the cast iron mixture with which we pour our sash weight castings. What is the proper proportion of steel to use in a mixture of this kind? Must we increase the amount of coke when melting steel. Any other information on the subject will be appreciated.

ANSWER

There is no such thing as a proper proportion of steel scrap to mix with the ordinary scrap iron mixture that is melted and poured into sash weight castings. These castings are subject neither to test nor specifications and may be poured from any material that will stand fairly rough handling in the various stages before they are installed in the window sashes. Once they are in place they will last practically indefinitely. Steel may be used in the mixture in any proportion, but unless the cupola man is highly competent, he will experience trouble with any mixture containing over 20 per cent steel. In fact, unless the cupola man is accustomed to melting extremely hot iron he will run into trouble in attempting to use 10 or 15 per cent steel. Formerly when the spread between the price of steel scrap and cast iron scrap amounted to anything between $5 and $10 a ton, a strong incentive was furnished to use all the steel scrap possible. Under present price condition with the price of certain kinds of steel and iron scrap parallel, the reason for using steel scrap in the cupola is not so strong. It may be that you are in a position to secure certain kinds of steel scrap at a more favorable price. If you have a skilfull cupola man, a cupola with high tuyeres and if you are accustomed to using coke liberally to secure blazing hot iron, you will experience no trouble in melting the steel scrap.

Q & A

New Sand Creates Gas

QUESTION

For your inspection and advice we are forwarding pieces broken from several light castings each piece containing what looks like a worm hole in the drag side at a point near where a pair of lugs is attached. Owing to greatly extended operation, also to the fact that castings are removed to the cleaning room while red hot and with a considerable amount of sand clinging to them, a great amount of new sand has to be added to the heaps each night. All the sand carried away with the castings is wheeled to the dump. We use a light coat of facing sand in the molds. It is mixed in the proportion of 1 part sea coal to 13 parts old sand, 2 parts sand from the cleaning room and 1 part sharp sand. We have been advised that the trouble is due (1) to the heavy percentage of new sand in the heap; (2) to hard ramming and moisture and (3) to the presence of sea coal. What do you think?

ANSWER

Practically all new sand contains organic matter in varying amounts and this material is converted into gas when the mold is filled with molten metal. Coal dust also is converted to gas under the same conditions. Your third theory may be discarded in this instance. If the sand was so hard or so damp that the metal would not lie against it, evidence would be found in blowholes all over the casting including the cope side. The trifling amount of coal dust in your facing mixture would not create enough gas to cause any trouble by itself, but when united to the gas given off by the organic material in the new molding sand,

it was just sufficient. Under extreme conditions where the sand causes the iron to *boil*, the effect is apparent. In this instance the sand was just a trifle on the dangerous side and the gas finally worked its way out of the metal before the casting set. This allowed the metal in the upper part of the casting to settle down into the lugs. The holes which appear in the drag side of the casting are shrink holes. Small, of course but still shrink holes. The obvious remedy is to use a greater proportion of old sand in your facing mixture. By old sand of course is meant burnt sand. Under present conditions with the high percentage of new sand in the heaps, you are using nearly all new sand in your facing mixture. Temporary relief until your sand heaps become normal may be secured by venting the drags with a wire especially in the vicinity of the lugs on the pattern.

Q & A

Makes Soil Pipe Cores

QUESTION

What is the latest and best way to make 2, 4 and 6-inch standard soil pipe cores. What is the correct grade of sand to use, its principal characteristics and where it can be purchased. Who makes or sells a machine for making these cores. Where can I find the average base price on soil pipe and fittings for the past three years.

ANSWER

Methods and equipment for making soil pipe castings have not changed materially in the past 10 or 15 years. The green sand cores are swept on cast iron barrels. The barrels are turned true on the ends and then are revolved in suitable bearings while the sand falls on them from an over head hopper. Gravity is the only force used to pack the sand to the required density. A straight edge with a shoulder near one end to form the bell end is used to strickle the core to the correct size. The cores are made from the same kind of sand used in making the molds. We are not familiar with the sources of sand supply in your district, but in all probability a local source is available. Find where the stoveplate foundries and the light gray iron foundries in your city secure their sand. The same material will be satisfactory for soil pipe molds and cores. We do not know of any manufacturer in this country who makes machinery for making green sand soil pipe cores. Establishments engaged in the production of these castings generally build their own in their own repair and maintenance shops, or, they have them built to their own special specifications by a local fabricator. Consult the advertising section of THE FOUNDRY for sources of sand and foundry equipment. Write to any of the principal manufacturers of soil pipe castings for a list of their prices during the past three year period.

Q & A

Molds With French Sand

QUESTION

Do you know of any book giving full instructions on how to make castings in French sand and under pressure.

ANSWER

So far as we know, no exclusive treatise ever has been written on the subject of castings poured under pressure in French sand molds. Articles dealing with various phases of the subject have been published many times in THE FOUNDRY. For example a detailed description of how statuary is made in French sand molds at the plant of a famous eastern manufacturer appeared in the April 1, 1927 issue. A general description of the same plant with the equipment, materials and methods was published in the June 1, 1927 issue. These articles cover such points as the characteristics and preparation of French sand, construction of pattern, mold and core, drying the mold, arrangement of gates and runner basin to secure pressure and rapid distribution of the metal. Information contained in these two articles or others that have been published at various times, should be sufficient for any practical molder to handle an occasional out of the ordinary job. Dexterity and speed, of course, only are developed by constant practice.

Q & A

Acid Corrodes Castings

QUESTION

We are casting tubs for handling hot sulphuric acid which are about 2 inches thick and weigh 2000 pounds. The mixture is made up of 600 pounds of pig iron, 300 pounds of scrap and 100 pounds of steel scrap. These do not last long and we would like to obtain a mixture that would resist the acid attack.

ANSWER

The only type of cast iron that successfully will resist the attack of acids excepting hydrochloric and hydrofluoric, is the high silicon iron which contains around 13 per cent silicon. However, this iron cannot be made in the cupola due to the high losses of silicon and melting difficulties. It also is difficult to cast due to its contraction and tenderness while solidifying. The next best suggestion is to melt a mixture that will give a low silicon, sulphur, total carbon and phosphorus and high manganese content in the casting. This should analyze about 1 to 1.5 per cent silicon; phosphorus, below 0.30 per cent; manganese, 1.0 to 1.25 per cent and sulphur and total carbon as low as possible. A mixture that will give approximately these figures will contain 250 pounds of steel scrap; 400 pounds of scrap, and 350 pounds of bessemer pig iron with about 1.5 per cent silicon. Addition of ferromanganese probably will have to be made to raise the manganese to the figure given unless you can obtain high manganese pig. Chromium and nickel are said to increase resistance to acid attack. Amounts suggested are about 0.5 per cent chromium and 1.0 to 1.5 per cent nickel. These may be added in the form of nickel and ferrochromium; chromium and nickel bearing pig iron, or an alloy of nickel and chromium.

Q & A

Foundry Practice Is Good

QUESTION

I should like to know how my foundry practice compares with that of others. We make gas and oil engines, diesel engine and air compressor castings. With a 25 per cent semisteel mixture I get good results on castings that are tested under water pressure. What is considered a good analysis for this class of castings? What is considered a good physical test on a 25 per cent semisteel mixture. How can I increase the strength of castings poured from straight gray iron charges made up of 1200 pounds No. 2X pig iron and 1300 pounds scrap. At present the strength of a bar slightly over 1 inch diameter varies from 2100 to 2800 pounds. The semisteel constituting the first two to five charges. All the pouring is done from a 2-ton ladle with the exception of the bench work.

ANSWER

From the data presented in your inquiry we should be inclined to say offhand that your practice compares favorably with that of other foundrymen engaged in the same line of work. A typical analysis for engine and compressor castings in which the metal thickness is about ¾-inch follows: Silicon 2.00 per cent, managanese 0.60 per cent, sulphur 0.06 per cent, phosphorus 0.30 per cent. A standard test bar poured from a 25 per cent semisteel mixture will break under an average load of 3500 pounds and show a tensile strength of approximately 35,000 pounds. Additions of steel, chromium and nickel will increase the strength of the iron poured from the gray iron charges if other elements in the iron are correctly proportioned.

Problems in Nonferrous Founding

By Charles Vickers

Adds Phosphorus To Mix

We have been experimenting with the following brass mixture: 82 per cent copper; 5 per cent lead; 11 per cent zinc; 2 per cent tin, and have been using a 15 per cent phosphor-copper for flux and cleaner. We are anxious to know what quantities of this phosphor copper we should add to get the best results. We are adding one ounce per hundred pounds of metal. We have found that our metal is quite brittle and difficult to machine, whereas 2 ounces phosphor copper per hundred of alloy produces compact, Closely-grained alloy, which seems to machine easier and with less wear on the tools. We will be pleased to have your opinion in regard to this matter.

Usually 2 ounces of phosphor copper is added to each hundred pounds of metal to make ordinary red brass castings, and we can find no objection to using that amount with the particular alloy mentioned. It is convenient to use a little cup that holds exactly the amount needed, and saves the furnace men's time in weighing each charge. The alloy has a yellowish shade when machined, and for that reason the alloy of 79 per cent copper; 12 per cent zinc; 7 per cent lead, and 2 per cent tin, usually is preferred. For a deeper bronze color an alloy of 85 per cent copper; 8 per cent lead; 5 per cent zinc, and 2 per cent tin will be found satisfactory for brasswork to resist 100 pounds pressure.

Q & A

Little Flux Is Needed

We would like to learn what amount of chloride of zinc we should use as a flux in melting aluminum, and on what basis this amount is figured.

In melting aluminum a layer forms on the surface of the molten metal that is thicker than the metal underneath, and if this is skimmed off to the clear metal, it will carry with it a substantial amount of aluminum that is more or less of a pasty nature. This is caused by the entanglement of molten aluminum with a dust-like dross that is present, and experience has shown that the addition of a small amount of a chloride has the effect of separating the metal from the dross. Chloride of zinc is efficient in causing this separation, therefore, it is largely used for the purpose.

The proper amount to use is as small a quantity as will do the work demanded of it, usually a piece the size of a walnut and if thoroughly stirred around on the surface of the aluminum, is all that is required. It is a waste of chloride and a detriment to the aluminum to use more than this small quantity. Excess of chloride causes specks to appear in the castings, due to inclusions of tiny particles of chloride, which after a time *weep* because of the affinity of the chloride of zinc for moisture. There is no basis on which to figure, than that it is better to use too small a dose, then repeat, than to add a large amount of relatively expensive material and waste it.

Q & A

Gives Machinery Alloy

We are making castings for the friction clutch of a guillotine used on a paper cutting machine and we find the castings are too soft. We used the following mixtures: (1) *64 pounds of copper; 7 pounds of tin, and 1 pound of zinc. This one lasted 18 months. No. 2, was 45 pounds of copper; 2½ pounds of tin, and 2½ pounds of phosphor tin. This one the consumers would not use as they could cut it with a file. Alloy No. 3 contained: 39 pounds of copper, and tin 10 pounds. This mixture was given us by the office and proved too hard. The original that came with the machine served for 5 years and we would like to obtain an alloy that will be as good.*

The first mixture used was in percentages: 88.88 per cent copper; 9.72 per cent tin; 1.40 zinc. This closely approaches the well known alloy copper, 88 per cent, tin, 10 per cent, and 2 per cent, zinc. The latter is widely known as government bronze, and is an excellent alloy to use for machinery castings. No. 2 alloy is another excellent mixture, a strong phosphor bronze, used for purposes where a strong bronze is needed, it is in percentages; 90 per cent copper; 5 per cent tin, and 5 per cent phosphor tin. Both these alloys were soft for the service to which they were put in this particular case. No. 3 alloy is a bell metal, approximately 80 copper and 20 tin, this goes to the other extreme and is too hard and brittle, although it is a good bell metal. We suggest the following alloy: 85 pounds of copper; 13 pounds of tin and 2 pounds of zinc.

Q & A

Alloy Resists Pressure

We are experimenting with a pressure valve made up of the following mixtures: (1) *90 per cent copper, 6 per cent tin and 4 per cent aluminum, and* (2) *90 per cent copper, 10 per cent tin.*

Kindly advise whether the above mixtures are satisfactory for pressure castings, and if not, give us a mixture that will be.

Mixture No. 1 is absolutely worthless and should be discarded to save money. Mixture No. 2 might be useful, provided it can be cast soundly, as it has a tendency to make porous castings. It should be deoxidized by adding 0.25 per cent phosphor copper. If an aluminum bronze is preferred, use an alloy of 8 per cent aluminum, 4 per cent iron and 88 per cent copper, and be careful in gating so that the metal will enter the molds quietly and without creating dross. A standard bronze for pressure castings is 88 per cent copper, 10 per cent tin and 2 per cent zinc. It should be treated with 2 ounces of phosphor copper per hundred pounds of metal. Sometimes it is modified for pressure work to 86 per cent copper, 10 per cent tin, 2 per cent zinc and 2 per cent lead. Another alloy is composed of 83 per cent copper, 11½ per cent tin, 4 per cent zinc and 1½ per cent lead. The above formulas will afford a selection from which a suitable alloy can be made which will cast satisfactorily and withstand pressure.

Gray Iron Institute Reviews Year of Progress

COSTS, merchandising methods, research, and trade practices are some of the important problems which were discussed at length at the second annual meeting of the Gray Iron institute, held in the Hotel Cleveland, Cleveland, Oct. 16. The progress which the organization has made during the past year and the fields for future endeavor, were outlined by the officers. Several speakers from outside the institute, brought messages on pertinent subjects.

The meeting was a success from every standpoint. The attendance was large with a registration of 119 representing 81 member companies. The list of those present contained names of foundrymen from 19 states and Canada and 42 cities were represented. The reports of committees indicated exceptional activity and the speeches presented much food for thought.

Following a report of the nominating committee, made at the afternoon session by chairman Franklin G. Smith, Osborn Mfg. Co., Cleveland, the following directors were elected for a term of three years: J. D. Coltman, Bullard Machine Tool Co., Bridgeport, Conn., Wm. J. Grede, Liberty Foundry Co., Wauwatosa, Wis., Ralph M. Hill, East St. Louis Casting Co., East St. Louis, Ill., and E. H. Williams, Vulcan Mold & Iron Co., Latrobe, Pa. One vacancy remains to be filled by the board of directors.

Immediately after the close of the meeting, the board of directors met and re-elected officers of the institute as follows: President, Walter L. Seelbach, Forrest City-Walworth Run Foundry Co., Cleveland, vice presidents, B. H. Johnson, Florence Pipe Foundry & Machine Co., Florence, N. J. and A. E. Hageboeck, Frank Foundries Corp., Moline, Ill., treasurer, H. S. Chafee, Builders Iron Foundry, Providence, R. I., and assistant treasurer, H. C. Wilson, Cleveland Co-Operative Stove Co., Cleveland.

Proposes Certification of Product

ESTABLISHMENT of a method of certifying the product of member foundries was proposed by President Walter L. Seelbach in an address which opened the morning session of the institute. Mr. Seelbach cited the work that has been done along this line by producers of certain types of motor oils, and suggested that a similar system be worked out for the gray iron institute whereby the seal or monogram of the institute could be used as a guarantee of quality. He suggested that the institute designate certain engineering testing laboratories in various sections of the country. These laboratories would determine if the member plant was producing a quality product, adhering to the trade customs of the institute, conducting business on a high plane and making deliveries according to promises.

WALTER L. SEELBACH

Find Gray Iron Uses

Mr. Seelbach also spoke briefly of the work of the various committees and departments during the first year of the institute. He pointed to the merchandising problem and stated that it was not the purpose to belittle or supplant any product, but rather to find new uses for castings where that engineering material may be used more economically. The educational work, which has been carried on by the institute, was mentioned, and it was proposed to increase the effort along that line.

Growth and development of the Gray Iron institute, from the planting of the idea to the recent additions to the growing list of activities were traced in the report of A. J. Tuscany, manager. At the opening of the second annual meeting, the membership of the institute was in excess of 200 gray iron foundries. During the past year, the public in general and engineers in particular, have given more attention to gray iron. Technical societies have devoted considerable time on their programs to the discussion of gray iron. The institute also has been successful in showing some manufacturing concerns the advisability of closing a foundry and buying castings on the outside and also has prevailed upon industries to continue to buy castings from jobbing shops rather than to build a foundry.

Mr. Tuscany spoke of the monthly

B. H. JOHNSON

trade report of statistical information which is being issued by the institute, of the establishment of a cost accounting department which will be headed by E. E. Pilgram, of the standard sales agreement, the book on uses of castings, the speakers bureau, and the work of the research committee.

A standard cost system is practically complete and probably will be ready for distribution in a short time, according to a report of the cost committee made by chairman J. L. Carter, Sacks-Barlow Foundries, Inc., Newark, N. J. Mr. Carter stated that considerable difficulty has been experienced in selecting the best cost method. After investigating all of the methods used by various groups

A. E. HAGEBOECK

throughout the country, it was found that all were practically alike except in the methods of determining cleaning and shipping costs. It was found that methods in use would lead to errors ranging from ½ to 1 cent per pound of castings. This condition results in lost profit.

After a thorough study, the committee has decided that the direct method is the only correct way to figure these costs. However, that method is involved, expensive and for many foundries impractical. Therefore it is recommended that the direct method be used for special jobs and that any other method may be used for the regular work, but the system in use should be checked frequently by the direct method. The results of the cost study will be published later in pamphlet form and in THE FOUNDRY. The committee also expects to recommend cost accountants in various districts who will be available for advice in installing the cost system.

Howard O'Neal, Western Foundry Co., Chicago, chairman of the finance and budget committee reported that sufficient funds are available to carry on the work of the various departments during the coming year. The report of the committee on merchandising, presented by Chairman Don McDaniel, Hamilton Foundry & Machine Co., Hamilton, O., recommended a survey of the gray iron industry by a disinterested party. The committee also recommended the establishment of a technical department, co-operation with various organizations engaged in a similar line of work, and the further use of the seal of the institute. The merchandising committee has developed a standard sales agreement and trade customs which now is in use, and has provided speakers for various groups, such as engineering societies, schools, universities, etc. It is thought that a slogan may be of considerable value to the institute and a contest was suggested as a means of developing interest.

Research Program

The research committee is studying the work of other associations and is using its energies to put into effect existing policies and to provide new ideas, according to Chairman B. H. Johnson, Florence Pipe Foundry & Machine Co., Florence, N. J. The committee is working on tentative recommended practices for certain types of gray iron castings. Twenty-five plants have been selected from which test bars will be obtained daily for several weeks. Information also will be secured regarding mixtures, raw materials, practice, etc. From the information obtained, it is expected that tentative recommended practices may be established. This will lead to recommended practices and later to standard practices for certain types of work. This will give engineers and designers information on the types of materials suitable for certain classes of work. The committee will have to see that all interested in the standards are informed of changes and that the standards are kept up-to-date. The institute also will take part in the work of the iron alloys committee of the Engineering foundation.

W. J. Grede, Liberty Foundry Co., Wauwatosa, Wis., reported for the statistical committee. He urged that arrangements be made so that the reports reach the proper person in the organization to give information on production and stocks. Production reports now are being received from 115 foundries. The committee would appreciate suggestions on the work that is being carried on and on future activities. President Seelbach suggested that each plant make a comparison between its own wage and production statistics and the report sent out by the institute.

A. J. Tuscany reported for the trade practice committee. He explained the trade practice conferences, which have been held by several hundred industries. The committee still is studying results.

"The Business Man and His Trade Association," was the subject of an inspirational address given by Dr. Hugh P. Baker, manager trade association department Chamber of Commerce of the United States, Washington, at a luncheon following the morn-

H. S. CHAFEE

ing session. Dr. Baker stated that one of the largest opportunities of the trade association today lies in the development of accurate facts on every phase of the business in the industry served. The greatest value of the trade association to industry, when measured over a period of years, is due to the fact that it produces better business, enlarges acquaintanceships and breeds confidence.

Dr. Baker pointed to the problems confronting industry. These include overproduction or overcapacity, price cutting, exchange of business or the invasion of sales territories, continuation of wasteful practices making for unsound competition, declining business due to lack of standards and falling quality. To be effective a trade association must have a program, one which may be applied to each individual business in the group. The speaker placed a sound cost accounting system at the head of the list of

programs for any trade association. A sound cost system, properly installed, makes for efficiency, stability and prevents ignorant competition and price cutting. He stressed the importance of gathering accurate business figures. Such information gives a business picture that is true and accurate. Trade promotion is another feature of the program which must not be overlooked. This consists of business research and education, including the development of every possible outlet for a product, finding new uses and the education of the public and individuals, advertising and servicing the commodity all of the way to the consumer. The speaker also mentioned the value of standard trade practices in helping to destroy unfair practices.

R. R. Cunningham, National Sales Development Service, Cleveland, spoke at the afternoon session on "The New Day Marketing." Mr. Cunningham explained that today everything is accomplished in a different manner than 20 years ago. We live, travel, eat, and work differently. For that reason it is necessary to attack the sales problem from a different angle. He believes that the greatest sources of business today are the undeveloped sources.

T. M. Harrison, Stevenson, Harrison & Jordan, New York and Cleveland, in a talk on "Labor Cost Control in a Jobbing Foundry," discussed the scientific system of predetermining molding and coremaking time allowances, which make wage incentives possible in jobbing foundries despite frequent changes and short runs. Mr. Harrison stated that in many plants, the price to be paid for piecework is set by the foreman and is based upon his experience. While this method is better than paying the day rate, it is not necessary to depend on the skill of the foreman when ways have been developed to determine the cost accurately.

Mr. Harrison, assisted by E. E. Bradway of the same company, illustrated the method of determining the time required for making a particular mold, a pattern for a laundry machine casting being used in the demonstration. The pattern first was measured and from this the pattern area and the pattern volume were determined. The flask size then was decided upon and the cubical content of the flask and the amount of sand were determined. By using curves, previously prepared to apply to the plant making the work, it was possible to read directly the time required for the false cope, placing the pattern, shoveling and ramming, rapping the pattern, placing the cores and chaplets, finishing and clamping. It was stated that the time required for making the computations on a pattern shown was about 4 minutes.

Three amendments were made to the by-laws, the changes having to do with the number required for a quorum, methods of making by-law changes and the use of the institute seal. An interesting discussion period brought the meeting to a close.

The annual banquet was held in the evening with a surprise feature at the close. This consisted of a stirring melodrama entitled "Before and After," in which the trials of the Leadpipe Foundry Co., were pictured in detail. The adoption of uniform cost and accounting methods, as

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adopted by the Gray Iron institute, changed considerably the picture presented in the second and final act. The cast was as follows:

Jimmie Leadpipe (a Foundryman)—..... E. E. Pilgram
Miss Myrtle .....Mrs. Fisher
Alexander Smart (Rep. of G.I.I.)..... .....A. J. Tuscany
Mr. Whathavyou (Out-of-town Foundryman).....H. B. Doty
(Office assistants, time keepers, etc.)

Revise Specification

Recently the American Welding society made a revision in the phosphorus content of its specification for welding wire for manganese steel such as crossing centers, frogs, switch points, dredge buckets and other parts where an extremely hard, tough surface is required. The requirements in analysis of this wire now read: Carbon, 1.10 to 1.35 per cent; manganese, 11.00 to 14.00 per cent; phosphorus, 0.05 to 0.09 per cent; sulphur, 0.007 to 0.04 per cent, and silicon, 0.10 to 0.20 per cent.

Book Review

Handbuch der Eisen-und Stahlgiesserei, Part II, Formen und Giessen, edited by C. Gieger, imitation leather, 584 pages, 7½ x 11 inches, published by Julius Springer, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, for $14.75 plus 15 cents postage, and in London from the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, for £2 15s 9d, postage extra.

During the decade which passed between the publication of the first edition and this second edition of the handbook of iron and steel founding, many changes have taken place in methods of molding and pouring. Material for this volume was contributed by C. Irresberger, a well-known German foundry engineer. The text matter is divided into six divisions, namely the introduction, hand molding, drying apparatus, steel and malleable molding, matchplates and molding machines, and pouring and casting machines. The introduction covers the molder and his profession, tools of the molder, wooden flasks, flaskless molding, steel flasks, and standards for flasks. The section on hand molding deals with cores, floor molding, simple flask molding, examples for simple flask-molding, core molding, sweep molding, loam molding, chill molding, molding for white iron castings, pipe founding, cylinder molding, molding art castings, etc. The section on drying apparatus describes blacking and drying, drying ovens and drying pits, and methods of heating. The fourth division on steel and malleable molding gives information on gating and shows specific examples of how the work is done. The section on matchplates and machine molding describes the making of matchplates and the various types of molding machines including the rigging for specialty work. The concluding division gives information on pouring, permanent mold machines, centrifugal casting machines, and core machines. Numerous illustrations assist the reader in following the text, and bibliographies pertaining to the subject will enable him to obtain further information. A name index and a subject index conclude the volume.

George R. Harrison has been appointed Cleveland representative for the Reading Chain & Block Corp., Reading, Pa. He will have his offices at 362 Rockefeller building.

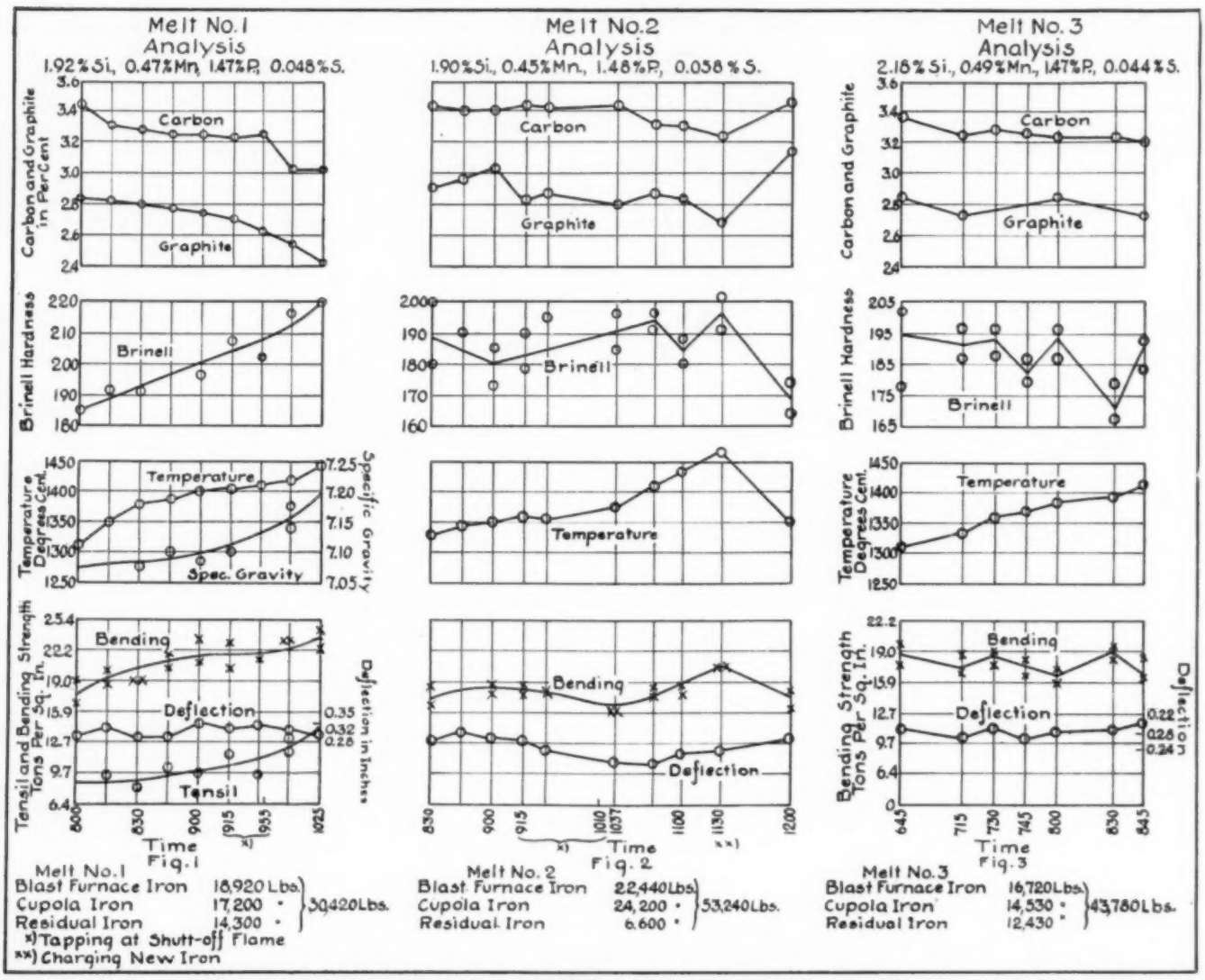
Study Furnace Reactions

German Foundry Employs Oil-Fired Furnace To Mix and Superheat Molten Blast Furnace and Cupola Irons

IN 1920 tilting, oil-fired, regenerative furnaces were installed in the pipe foundry of the Bayer. Berg. Hutten und Salzwerke A.-G., Amberg, Germany. These furnaces fulfilled two purposes, acting as reservoirs for molten meltal from the blast furnaces and the cupolas, and as refining and superheating furnaces. These oil-fired furnaces were developed by Hesse, and recently extensive experiments were undertaken to determine the changes occurring in the molten iron during the period it was held in the furnaces. Two furnaces with capacities of 25 tons each are used alternately. One is in operation day and night from three to four weeks while the other is being repaired. A description of the salient points of the furnaces, and the results obtained in the experiments are given by Hesse and Pinsl in *Die Giesserei*, March 30, 1928.

Sectional views of one of the furnaces are shown in Figs. 4, 5 and 6. The upper tilting part contains the hearth and checker chamber and the bottom part with the tilting apparatus also is used for heating the air for combustion, as the flues partly are provided with checkers as shown in Fig. 6. The location of the tilting points has been chosen in such a way, that only 150 tons of the total 400 tons weight of the upper part has to be raised. The tilting angle is about 20 degrees. A water seal has been provided between the tilting part and the lower stationary part so that in any position it furnishes an air-tight seal, which prevents heat losses between the two parts. The bath has a depth of 12 to 13 inches.

The roof of the furnace lasts 1000-2000 heats, depending upon the size of the furnace. Hearth and side walls last much longer. The checkers of the side chambers and especially those in the bottom part have a long life. Waste gases leave the flue to the



FIGS. 1, 2 AND 3—CURVES SHOWING THE CHANGES OCCURRING DURING THE MELTING OF THREE HEATS OF HIGH PHOSPHORUS CAST IRON FOR PIPE MAKING

chimney with a temperature of 200 degrees Cent. The burner arrangement consists of nine burners on each side, and a good mixing with the hot air takes place, because the dispersed oil forms a curtain over the air flue. The burners are water cooled and their life is increased to a great extent. Loss in the furnace is small. Generally it is charged with 50 per cent hot iron from the blast furnace and 50 per cent iron from the cupola, which is almost entirely composed of scrap. Sulphur never exceeds 0.06 per cent.

To determine the changes occurring in the iron during a melt, a number of experiments were made. After the last iron was charged a small spoon of iron was taken out every 15 minutes from which two bars were cast vertically in dry sand molds. These bars were 1 3/16 inches in diameter and 25⅝ inches long. At the same time the bars were poured temperature of the iron was determined with a pyrometer. Each bar was tested for bending strength and deflection, a greater part for tensile strength, brinell hardness and specific gravity. All bars were chemically analyzed. The results are given in the accompanying table and in the diagrams Figs. 1, 2 and 3.

Fig. 1 shows that the influence of overheating in melt No. 1 on bending and tensile strengths, Brinell hardness and specific gravity, can be observed distinctly. The furnace charge consisted of 22.5 tons, of which 28.1 per cent was iron of the previous charge, 37.2 per cent hot blast-furnace iron and 34.7 per cent cupola iron. The bar of the last furnace iron had a bending strength of 31,360 pounds per square inch and that of the cupola iron was 39,200 pounds per square inch. It will be seen, that

Results of Tests on Three Furnace Heats

Time	Test No.	Temperature of Furnace Iron Degrees Cent.	Analysis Si %	Mn %	P %	S %	T.C. %	Gr %	C.C. %	Bending Strength of Standard Bars Lbs. per sq. in.	Deflection in inches	Tensile Strength lbs. per sq. in.	Brinell Hardness	Specific Gravity	Remarks
MELT NO. 1															
8:00	1	1370	2.39	0.56	1.45	0.040	....	....	....	33420	0.30				Blast Furnace Iron
	2	1308	....	....	....	....	....	....	....	41260	0.28				Cupola Iron
	3	1308	1.96	0.42	1.46	0.040	3.44	2.85	0.59	38550	0.30		187	....	
	4	....	....	....	....	....	....	....	....	43389	0.30		....	....	
8:15	5	1348	1.99	0.48	1.47	0.030	3.33	2.84	0.49	46234	0.32	20608	192	7.092	
	6	....	....	....	....	....	....	....	....	42806	0.32	....	....	....	
8:30	7	1375	1.93	0.41	....	0.041	3.29	2.80	0.49	42672	0.30	19488	192	7.078	
	8	....	....	....	....	....	....	....	....	42672	0.30	....	....	....	
8:45	9	1385	....	....	....	....	....	....	....	46816	0.30	21907	202	....	Furnace Iron
	10	....	1.91	0.45	....	0.047	3.25	2.77	0.48	49347	0.30	....	....	7.107	
9:00	11	1400	....	....	....	....	....	....	....	46659	0.33	21773	196	....	
	12	....	1.91	0.46	....	0.044	3.25	2.74	0.51	53491	0.33	....	....	7.092	
9:15	13	1405	....	....	....	....	....	....	....	45517	0.32	24752	207	....	
	14	....	1.91	0.47	....	0.044	3.26	2.71	0.55	51900	0.33	....	....	7.098	
9:30	14a	1405	1.92	0.43	1.43	0.032	3.25	2.65	0.60	47376	0.32	....	202	....	
10:10	15	1412	....	....	....	....	....	....	....	52640	0.32	29434	217	7.145	
	16	....	1.91	0.42	....	0.048	3.03	2.55	0.48	54051	0.30	27888	....	7.155	
10:25	17	1445	1.90	....	....	0.050	3.04	2.45	0.59	56336	0.30	....	221	7.170	
	18	....	1.93	0.46	....	0.051	3.04	2.42	0.61	49773	0.30	28749	....	....	

Tapped 16 tons from 9:15 to 9:40, flame shut off. Between 9:40 and 9:55 recharging, about 2 tons iron not used. Between 9:55 and 10:25 further superheating of the residual iron.

MELT No. 2

8:30		1350	....	....	....	....	....	....	....	37699	0.30	....	....	....	Blast Furnace Iron
	2	1336	....	....	....	....	....	....	....	42672	0.30	....	....	....	Cupola Iron
	3	....	....	....	....	....	....	....	....	35146	0.24	....	....	....	Residual Iron
	4	1340	1.90	0.45	1.50	0.058	3.42	2.92	0.50	41955	0.35	....	202	....	
	5	....	....	....	....	....	....	....	....	37408	0.33	....	179	7.035	
8:45	6	1356	....	....	....	....	....	....	....	....	....	....	....	....	
	7	....	1.89	0.46	....	0.060	3.42	2.99	0.43	45651	0.35	....	192	7.020	
9:00	8	1362	....	....	....	....	....	....	....	41238	0.33	....	187	....	
	9	....	1.91	0.35	....	0.040	3.41	3.04	0.37	40970	0.33	....	174	....	
9:15	10	1362	1.89	0.41	....	0.060	3.43	2.87	0.46	41798	0.33	....	192	....	
	11	....	....	....	....	....	....	....	....	39962	0.33	....	179	....	
9:25	12	1362	1.89	0.45	....	0.047	3.43	2.90	0.53	40253	0.33	....	196	....	
10:37	13	1377	1.87	0.39	....	0.055	3.42	2.81	0.61	36266	0.28	....	183	....	Furnace Iron
	14	....	....	....	....	....	....	....	....	36266	0.30	....	196	....	
10:55	15	1398	....	....	....	....	....	....	....	39302	0.28	....	196	....	
	16	....	1.84	0.30	....	0.055	3.34	2.90	0.44	40813	0.28	....	192	....	
11:10	17	1439	1.86	0.40	....	0.055	3.34	2.87	0.47	39862	0.30	....	179	7.063	
	18	....	....	....	....	....	....	....	....	41395	0.30	....	187	....	
11:30	19	1468	....	....	....	....	....	....	....	46928	0.32	....	196	7.053	
	20	....	1.89	0.44	1.48	0.057	3.23	2.70	0.53	46659	0.28	....	207	....	New Iron Added
12:00	21	1350	2.09	0.46	1.42	0.041	3.44	3.14	0.30	40253	0.35	....	174	....	
	22	....	....	....	....	....	....	....	....	36131	0.32	....	183	....	

Tapped 19 tons between 9:15 and 10:10—flame shut off. Superheating of residual iron from 10:10-11:30. 6 tons blast furnace iron charged at 11:30. Superheating till 12:00.

MELT NO. 3

6:45	1	1318	....	....	....	....	....	....	....	46234	0.33	....	179	7.027	
	2	....	2.30	0.51	1.46	0.045	3.36	2.90	0.46	41395	0.28	....	212	....	
7:15	3	1339	2.14	....	....	....	3.25	2.77	0.48	40454	0.28	....	196	....	
	4	....	....	....	....	....	....	....	....	39267	0.26	....	187	....	
7:30	5	1351	2.13	....	....	....	3.26	....	....	42672	0.32	....	196	7.074	Cast at 1308 degrees Cent.
	6	....	....	....	....	....	....	....	....	41530	0.30	....	192	....	
7:45	7	1362	2.04	....	....	....	3.26	....	....	41261	0.26	....	187	....	
	8	....	....	....	....	....	....	....	....	36982	0.26	....	179	....	
8:00	9	1372	2.26	....	....	....	3.25	2.84	....	37834	0.30	....	187	....	
	10	....	....	....	....	....	....	....	....	35123	0.28	....	196	....	
8:30	11	1393	2.09	....	....	....	3.26	....	....	40678	0.26	....	166	....	
	12	....	....	....	....	....	....	....	....	43792	0.30	....	179	....	
8:45	13	1410	2.28	0.48	1.49	0.040	3.25	2.70	0.55	49347	0.30	....	202	7.092	Cast at 1410 degrees.
	15	1410	2.18	0.48	1.46	0.046	3.20	2.77	0.43	37408	0.30	....	183	....	
	16	....	....	....	....	....	....	....	....	40678	0.28	....	192	7.073	Cast at 1308 degrees Centigrade.
	17	....	....	....	....	....	....	....	....	....	....	....	....	....	

With exception of No. 13, all bars were cast at 1308 degrees Cent.

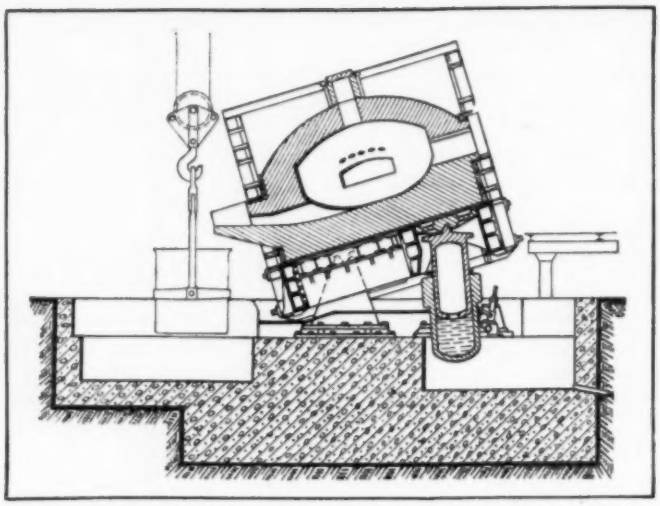


FIG. 4—CROSS SECTION AT *A-B* SHOWING THE TILTING MECHANISM. THE TILTING IS DONE BY A HYDRAULIC CYLINDER WHICH LIFTS THE BACK OF THE FURNACE SO THAT A POURING ANGLE OF 20 DEGREES IS FORMED

this value has increased to 39,648 tons per square inch a quarter of an hour after charging and beginning of blowing, and at 10:25 a.m. has increased to 50,400 pounds per square inch. One bar showed 56,336 pounds per square inch. Tensile strength increases from 19,936 to 28,448 pounds per square inch, the brinell hardness from 187 to 217 and the specific gravity from 7.08 to 7.17, showing the increase of density. Fifteen minutes after the beginning of blowing the temperature reaches 1308 degrees Cent., at the end of the melt 1445 degrees Cent.

Analyses given in the table show that silicon, manganese, phosphorus and sulphur have undergone no change of practical importance, the values are nearly constant from beginning to the end of the melt, only carbon and graphite change. The total carbon content decreases slowly about 0.15 per cent during the first 2 hours. Graphite decreases from 2.85 to 2.42 per cent during the period mentioned.

The authors summarize the results of their experiments as follows: Superheating of iron with high phosphorus content in an oil reverberatory furnace increases the bending strength up to 40 per cent. It also increases the tensile strength, brinell hardness and the specific gravity. Temperature must increase increase rapidly during the melt, so that a temperature of 1400 degrees Cent. is maintained as long as possible.

It is important that the normally superheated iron also is cast hot.

If the temperature decreases, the values for strength also decrease. Loss of carbon is about 0.1-0.15 per cent as long as no iron is tapped. On superheating the residual iron, the loss increases to about 0.5 per cent. The loss of the other constituents is without importance.

Graphite content decreases with increasing superheating in the same relation as the content of carbon decreases. The content of combined carbon remains about the same.

When the metal is superheated above 1400 degrees Cent. and cast hot, a refinement of the graphite is observed.

Losses Are Slight

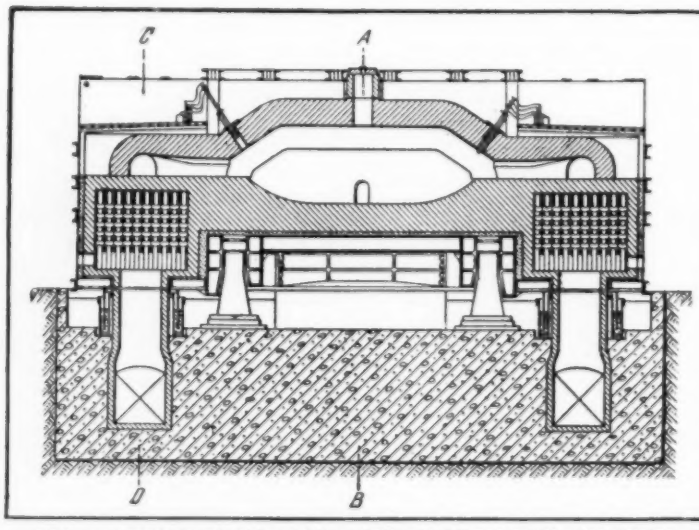
TEST bars cast every 15 minutes from an oil-fired reverberatory furnace give some interesting data on the changes during the superheating of mixed blast furnace and cupola irons. Losses in elements of the iron are slight, but an increase is evident in the physical properties. This article is abstracted and translated from a paper published in Die Giesserei by Herman Illies, consulting engineer, Amburg, Bavaria, Germany.

Book Review

1929 *Supplement to Book of A. S. T. M. Standards*, paper, 6 x 9 inches, 293 pages, published by the American Society for Testing Materials, Philadelphia, and supplied by THE FOUNDRY, Cleveland, for $1.50 plus 15 cents postage, and in London from the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, for 7s 6d., postage extra.

This volume is the second supplement to the 1927 book of standards issued by the society and contains 51 standards adopted or revised by letter ballot on Sept. 3, 1929. Thirty-two of the standards appearing in this volume are new standards and the remaining 19 are replacements of existing standards. Foundrymen will be interested in the following standards which have been included: Carbon steel castings for valves, flanges and fittings for high temperature service; cast iron soil pipe and fittings; gray iron castings; arbitration test bar and tension test specimen for cast iron; high test gray iron castings, and recommended practice radiographic testing of metal castings.

Hill-Curtis Co., Kalamazoo, Mich., maker of sawing, polishing and grinding machinery, has changed its name to Hammond Machinery Builders Inc.



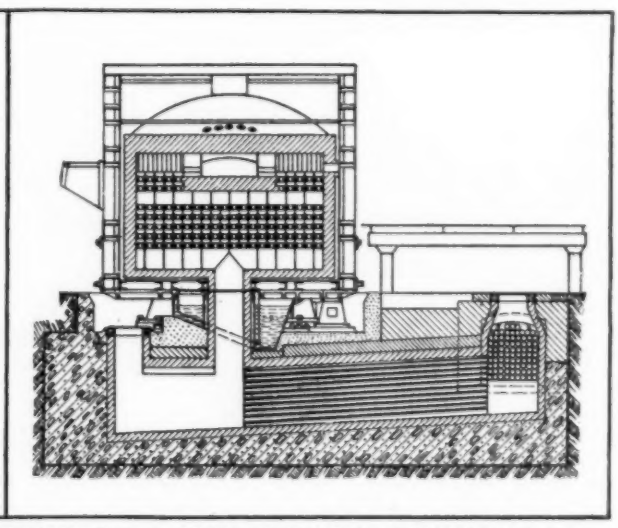


FIG. 5—LONGITUDINAL CROSS SECTION OF TILTING, OIL-FIRED FURNACE. FIG. 6—CROSS SECTION OF FURNACE AT *C-D*

Producing Steel Castings in the Modern Foundry

Part XI

By Charles W. Veach

ORIGINATING in the pouring bay, the filled molds move to the shakeout where the castings and sand are removed from the flasks. Flasks are transported to the molding room, castings are taken to the rough chipping room, and the sand is conveyed to suitable hoppers.

If the molds are shaken out on the floor and the sand is cut by hand, it has a chance to cool. If the sand is elevated to hoppers and remains there only a few hours before it is retempered, it may be hot when it reaches the bins located at the molding machines. Hot sand causes drop-outs, not only when the cope is removed from the pattern, but occasionally after the mold has been closed. Hot sand also may cause scabs which spoil the appearance of the casting and generally results in rejection by the customer's inspector.

Ample Storage Needed

To insure that the sand will cool properly during the interval between shaking out and mixing, ample storage space is desirable. Sand generally is conveyed to the bins by belt conveyors, and if carried from the bins to the mixer by the same method, no water must be applied or it will not feed from the bins on the belt by gravity. If a sufficient number of bins are provided, the sand has time to cool properly and trouble will be avoided.

When the castings reach the rough chipping room the gates and risers are broken off with sledge hammers. This applies to all work of thin section which requires no heavy feeders. Heavy feeders and gates are removed by saws or cutting torches. Sand still sticking to the castings and the cores is knocked loose either with hand or mechanically operated hammers, and the castings are given a preliminary inspection. Any castings found to be defective beyond repair are scrapped. That prevents any further work being done on them. Those passing inspection are ready for annealing or the heat treating operation.

In some steel foundries using the basic open-hearth process, all castings scrapped in the rough chipping room are sent through the sandblast to remove clinging sand before they are returned to the furnace department for remelting. In a few such foundries, the gates, risers, and runner cup scrap are rattled in tumbling barrels to remove the sand. Some foundries do not take this means of saving wear on the furnace bottoms but it pays in less bottom upkeep expense and makes the work of the furnace helpers easier.

The subject of heat treating is too broad to be discussed at length in this article. However, every steel foundryman should acquire some knowledge of this phase of the manufacture of steel castings. Plain carbon steel castings either are annealed or receive normalizing treatment. However, a large tonnage either because of the tremendous weight of the casting, or because of the service required, receive no heat treatment. Such castings generally are allowed to cool slowly in the mold before shaking them out of the flasks.

Without duplicating any literature dealing with the science of heat treating, the annealing of plain carbon castings may be discussed briefly. Castings are annealed for the specific purpose of refining the grain of the metal. In the parlance of the shop, castings are under, over or properly annealed. It has been established that heating steel with 0.20 to 0.30 per cent of carbon to from 1550 to 1600 degrees Fahr. is sufficient to give silky grain refinement. However, a true silky fracture seldom is attained except in higher carbon steel castings.

Two Phases Constitute Annealing

D. K. Bullens in his book, *Steel and Its Heat Treatment*, says that an annealing operation consists fundamentally of two well-defined and coordinated phases, the heating and cooling operations. The importance of both must be understood by the man operating the furnace before he can produce good work. While the operator is better equipped to do good work if he understands the theory of annealing, such knowledge is not as important as experience, provided the operator takes an interest in his work, and has recording instruments to guide him.

Time is an important factor in both phases of the annealing process and often is neglected during the heating phase. The danger of heating too rapidly is greater where the continuous furnace is used than where the castings are charged into the furnace intermittently and discharged after the annealing period. Slow and

Finishes the Castings

AFTER the molds have been poured and the castings have cooled sufficiently, they are shaken from the molds. The sand is returned to bins to be used again and the castings are taken to the cleaning and finishing departments. In this the eleventh article of a series on the production of steel castings in the modern foundry, the author gives some of the requisites of a sand handling system, and discusses annealing, chipping, sandblasting welding and inspection briefly. He traces the castings through the various stages of production and gives many suggestions as to the methods that will speed up production and reduce foundry costs. He also describes the part the chemical laboratory plays in controlling the properties of the product in co-operation with the melter and the annealing furnace operator.

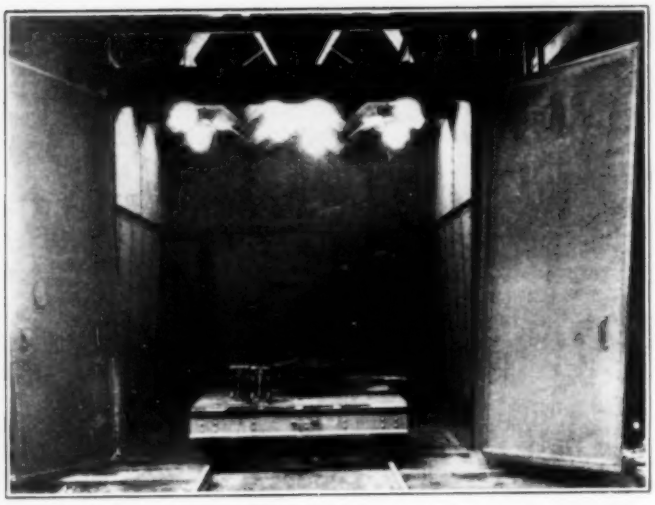


FIG. 21—SAND BLAST COMPARTMENT IN A LARGE MIDWEST STEEL FOUNDRY

uniform heating always is advisable, regardless of the chemical composition or physical condition of the steel. Heating from 1550 to 1600 degrees Fahr. results in changes depending on the physical condition before the castings are charged into the furnace. While good annealing should remove all normal casting strains, it is not safe to assume that strains in an aggravated form will be removed entirely by one annealing operation unless more than the usual amount of care is exercised.

If the castings are allowed to cool in the mold, the grain of the steel will be coarse, and the internal strains will be proportionate to the intricacy of the casting, and to the extent that the cores oppose the natural shrinkage of the metal. In this coarse grained condition, the ultimate strength of the steel will be high but the elongation and reduction of area will be low. Without annealing and without heating sufficiently to relieve the internal strains, castings containing more than 0.20 per cent carbon, and about 0.65 per cent manganese would be unsuitable for use. Annealing gives them exceptional quality and *they give as good service as forgings or rolled stock.*

Gives Requirements

The physical requirements demanded of steel castings are high ultimate strength, at least 22 per cent elongation, about 35 per cent reduction of area, and elastic limit at least 50 per cent of the ultimate strength. If the specifications call for 70,000 to 80,000 pounds per square inch ultimate strength, and elongation and reduction of area as given previously, the steel must contain approximatey 0.25 per cent carbon, and 0.65 per cent manganese. A steel of that analysis will have the ultimate strength required, but without proper annealing it will not have the ductility shown by the elongation and reduction of area. Proper annealing is the only means of conferring the ductility required. Some heats will be a few points high in carbon. If both the carbon and manganese are up the ultimate strength will exceed 80,000 pounds per square inch. The elongation and reduction of area will be correspondingly lower, and will come under the specification only with the most painstaking care in annealing.

In producing castings for railway equipment and many other uses where great strength and resistance to transverse stresses are required, it is desirable to control the physical qualities of the steel within narrow limits. The first effort is made by the men producing the metal but there are limits in the control of the carbon and manganese contained in the steel. Occasionally a heat is tapped which contains an excess of one or both of these elements. Some heats also may be tapped with the carbon and manganese on the low side. In the latter case the ultimate strength will be under the low limit while both elongation and reduction of area will be high.

By controlling the time element in the annealing operation both of these extremes may be made to give the same result that is obtained when the carbon and manganese are correct. Thus a product having uniform physical properties may be produced daily. It is necessary for the melters to control the carbon and manganese in the steel. Assuming that they do their best to keep these elements within bounds, and that only occasionally a heat is tapped where these elements exceed or fall below the specifications, care in annealing these *off* heats will give them approximately the same physical properties possessed by normal heats.

Laboratory Must Co-operate

Before close control by the melter and the annealing furnace operator can be established, the laboratory must furnish each with the chemical analyses they require. A preliminary analysis informs the melter of the residual carbon and manganese content of his metal at the time he is about to tap the heat. From this analysis, he adjusts the amount of ferromanganese added to the metal as it flows into the ladle. Assume that the heats are charged so that the amount of manganese remaining in the bath immediately before tapping is approximately 0.26 per cent. The additions of 80 per cent ferromanganese to the bath to give the required manganese content in the final product will be based on that

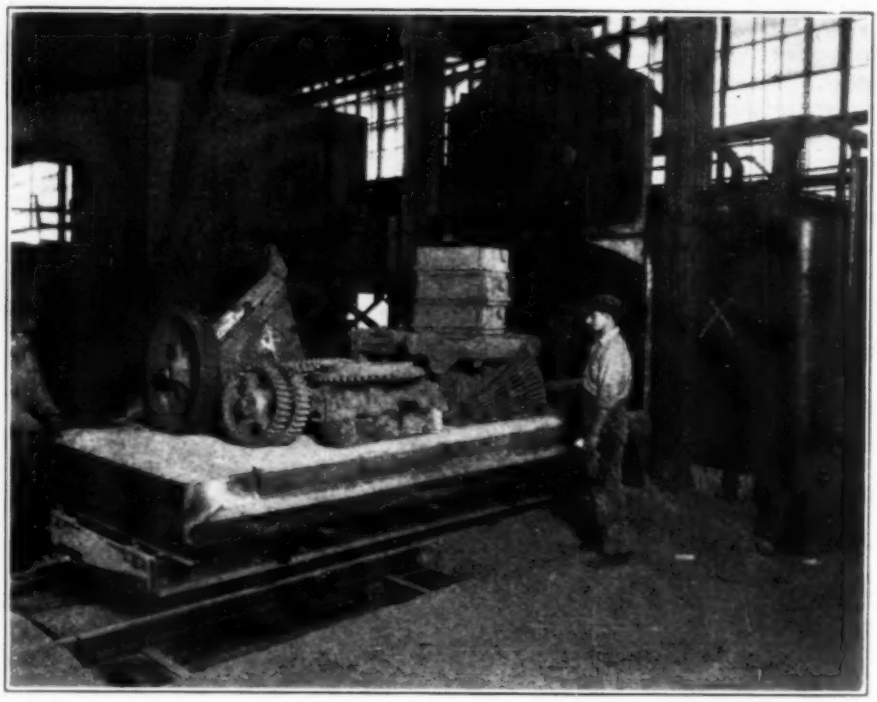


FIG. 22—CAR TYPE FURNACE USED TO HEAT TREAT STEEL CASTINGS

amount. For instance, if the manganese content in the steel is specified as 0.65 to 0.70 per cent, sufficient amount will have to be added to the bath to make up for the deficiency plus an amount to take care of the loss after addition.

Since the amount added is based on a residual manganese of 0.26 per cent, if the preliminary test shows the manganese to be higher or lower than that figure, an amount of ferromanganese must be added or deducted from the total amount to be added to correct the content of the bath. The usual procedure is to add 10 pounds of ferromanganese to the addition for each 0.01 per cent if the residual manganese is lower than 0.26 per cent or deduct the same amount if the figure is higher. This amounts to about 0.01 per cent per ton in a furnace melting 30 tons of metal.

Extra Manganese Raises Carbon

The procedure described is followed at the discretion of the melter. If the residual manganese is high, say 0.29 per cent, and the carbon is low, say 0.18 per cent, if he wants to finish with 0.25 per cent carbon and 0.65 per cent manganese in the product, he will aim at 0.70 or 0.75 per cent manganese, and 0.21 per cent carbon in this particular case.

The extra manganese in this case will help raise the carbon and it will then require only a small addition of coal or coke to gain the carbon required to insure 0.21 or 0.22 per cent of this element in the product. As soon as a test is available after the heat is poured, the chemist ascertains the carbon and manganese contained in the steel. This information is available to the man operating the annealing furnaces in plenty of time for him to determine the treatment the castings require. The expense of the preliminary laboratory can not be considered as an objection because of the saving in ferromanganese made possible by its work. Experience has shown that this saving is equal approximately to the salary of the chemist employed.

After the castings have been heat treated, they should move directly from the annealing furnaces to the sandblast. A few years ago sandblasting was about the least desirable occupation in a steel foundry. Conditions in this phase of the industry have improved greatly. For years the sandblasting operation came before annealing, in a number of steel foundries. When it was found that annealing loosened the clinging sand and made sandblasting easier, the operations were reversed. In addition to improving the appearance of the castings, the reversal of the operations reduced the expense of the sandblasting.

Some castings have sand burned in their surface. Objections to this defect are poor appearance and difficult machinability if the surface is to be machined. Desire for surface appearance is such that considerable money often is expended acquiring it. Annealing before sandblasting aids in attaining a high finish on the castings' surfaces and makes them more acceptable to the customer's inspectors.

At one time the enclosure for the sandblasting operation was small, dark, and the atmosphere heavily charged with fine sand, which was injurious to the health of the workmen. With enlargement of the enclosure, installation of lighting systems and dust arresters, the work is considerbly more healthful, pleasant and safe. During the sandblasting operation, pellets fly in all directions and any exposure of the workman's body is sure to result in injury. Effort should be made in trying to mechanize this operation so that machines and not men will be exposed to these conditions.

After steel castings have passed through the sandblast, they are in condition to receive a thorough inspection. Prior to sandblasting, castings are covered with places where sand is clinging or is burned-in. In that condition it is impossible to discover all defects, or to judge the extent that some would affect the casting. As the castings come from the sandblast with the adhering sand removed, a careful inspection will reveal all defects. Their nature extent and method of removal then may be determined. Inspection at this point saves expense of chipping and welding castings which may have defects that cannot be remedied. Any defect of such importance as to make acceptance doubtful should be held until passed upon by someone in authority.

Castings passing inspection are taken to suitable benches by overhead cranes where the chippers have easy access to them from all sides. Castings of like design are segregated, and if sufficient number are available, a chipper should be assigned a certain design for his day's work. He may work on the same type of casting for an indefinite period but usually his work changes from day to day.

FIG. 23—INSPECTION IS ONE OF THE IMPORTANT OPERATIONS IN A STEEL FOUNDRY

Welding may be done on the chipping benches but it is advantageous to have a space allotted for that operation. Benches should be provided so the welders do not have to work from the floor. The space where chipping is done should be kept clean and orderly. Floors in that conditions promote better work and greater production. Castings move from the welder's benches to the space provided for the foreign inspectors. Here the castings are given a final inspection by the company inspectors. Gages are used and, if they do not fit properly, adjustment is made before the customer's inspector looks over the casting.

The company should have an adequate force of inspectors so that all

work is acceptable before it is turned over to the customer's inspectors. One or two competent men should work with the customer's inspectors. A chipper and a welder should be available so that any small adjustment that must be made at the request of the inspector can be done quickly. This expedites the work of the customer's inspectors and helps to clear the benches and make room for other castings.

Chipping Is Large Expense

It nearly is impossible to make steel castings of intricate design without surface defects. The defects which do not cause the casting to be rejected after emerging from the sandblast are repaired by welding. They usually affect only the surface of the casting, and are repaired to improve the appearance. All castings require chipping to remove fins, uneven surfaces, and other defects and to prepare the weldable defects for the welders by chipping out to expose clean metal.

Where castings are produced on a production basis, using stripper-plate machines, and where little or no skilled labor is employed in the molding room, the chipping expense usually is about half the molding cost. The largest single item contributing to the chipping expense is fins caused by metal filling the interstices between cores in the mold. A little care in the setting of cores will prevent many fins on the castings and this speeds up the chipping operation.

Good chippers are an asset to any steel foundry where that operation is a problem. It requires considerable time for a man to become dextrous with a chipping hammer. Where there are high peaks of production followed by dull periods requiring laying off of chippers, labor turnover is high at each resumption of operations, particularly if the dull period is of long duration. Men are loath to return unless steady employment is promised.

Some steel foundries pay an hourly rate to the men beginning as chippers until such time that they are able to earn more at the piece rate price prevailing. While on the hourly rate they are classed as students but, when sufficiently skilled to earn a fair day's pay, they are classed as chippers. Out of 50 men hired as student chippers 25 will leave in a few hours to a few days. A number of those remaining will leave before they become able to earn their day rate. Others will remain as long as they receive their day rate, but as soon as they are placed on piece work rate they leave. If ten good chippers are developed from the 50 men hired the foreman thinks he is lucky.

The man causing the greatest expense is the one who remains as long as he is paid the day rate, and leaves as soon as he is placed on a piece work rate. His output generally is not sufficient to pay for the instruction he receives. After carrying a man this far, it often turns out that if he is offered something else before he leaves, he accepts and makes good.

If a large volume of work is produced, several experienced chippers may be employed advantageously as pace makers for the chipping crew. Chippers should be furnished with gages and instructed in their use. This saves rechipping and is advantageous to both the chipper and the company. It happens not infrequently that castings are taken from the chipper's benches to the welder's benches where it is discovered that some of the gages do not fit and a chipper has to be called to do the work over.

Marks the Work

If the chipper's identity is lost before the faulty work is discovered the company pays extra to have the casting rechipped. One way to retain the identity of the chipper until his work has been properly inspected even if transported to another part of the room, is to assign to each chipper a certain identification mark which is placed on the casting assigned to him with the understanding that it must not be erased. This should improve the workmanship, and should save the company rechipping expense.

Service to the chippers is one of the most important factors of this phase of foundry work. Keeping them supplied with castings, removing castings as soon as finished, avoiding crowding of the benches and keeping the floor clean all contribute to the efficiency of the chipping crew. The room should be supplied with all the windows possible and these should be kept open as much as weather conditions will permit. The noise produced by a larger number of chipping hammers is not pleasant, and is much worse in a closed room than it is when the room is open.

Richard M. Egan, president, Egan, Webster & Co. Inc., Pittsburgh, fire clay producers, has been appointed assistant to the president of the General Refractories Co., Philadelphia. He will continue as president of Egan, Webster & Co., although this company is not affiliated with the General Refractories Co. Albert R. Kenney, has been made sales manager for Egan, Webster & Co. Inc., Pittsburgh.

Book Review

Recent Economic Changes in the United States, cloth, two volumes, 950 pages, 6 x 9 inches, published by the McGraw Hill Book Co. Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $7.50 plus 15 cents postage, and in London from the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, for 37s 6d.

This work represents the report of the committee on recent economic changes of the president's conference on unemployment. The survey culminating in this report was begun in January, 1828, and was completed in February, 1929. It represents an analysis of development in American economic life in the period since the war, and lays particular stress upon the recovery since the depression of 1920-21.

The work is comprehensive and represents an important contribution to industrial progress. Influences affecting employment and living standards are analyzed. Under the heading of industry, the report discusses changes in new and old industries, technical changes in manufacturing industries and the changing structure of industry. Other features discussed include construction, transportation, marketing, labor, management, agriculture, price movements and related industrial changes, money and credit and their effect on business, foreign markets and foreign credits and the national income and its distribution.

Gives Equipment Orders

The index of gross orders for foundry equipment for September was 218.7 as compared with 229.5 for August, according to a recent report of the Foundry Equipment Manufacturers' association. The index of shipments for September was 176.8 as compared with 150.3 for August. Unfilled orders for September were 480.8 against 441.1 for August. The base is the average monthly shipments for the years 1922-23-24. Comparison of monthly orders as presented by the association follow:

Month	1926	1927	1928	1929
Jan.	168.2	180.4	132.7	180.5
Feb.	154.9	198.0	123.6	197.0
March	157.3	131.1	138.6	209.4
April	113.2	130.0	107.7	172.6
May	128.5	134.8	335.6	177.7
June	133.5	138.4	149.1	177.3
July	127.3	89.9	94.8	219.3
Aug.	141.2	106.4	278.0	229.5
Sept.	114.0	80.4	170.0	216.3
Oct.	140.5	98.0	185.0	.....
Nov.	133.4	95.8	197.8	.....
Dec.	181.0	106.8	166.5	.....

Otto Abrahamsen, formerly treasurer and in charge of sales of the Beaudry Co. Inc., Boston, has become affiliated with the Moloch Foundry & Machine Co., Kaukauna, Wis. Mr. Abrahamsen is in charge of sales of the Moloch company.

Sprocket Patterns

Are Produced Accurately on a Gear Cutter

BY H. N. TUTTLE

MANUFACTURE of sprocket patterns holds an important position in the agricultural machinery field. This is true not only because sprockets are used in large numbers but because a troublesome sprocket will cause considerable trouble in the machine. The root circle, or that part of the sprocket where the chain rests, must be made to accurate dimensions, considered from the standpoint of rough casting dimensions. Unlike a gear pattern, there is no bottom clearance between the teeth of a sprocket. On the contrary, the chain rests directly on this root diameter, so that any variation in the dimension will make a corresponding variation in the circular pitch of the sprocket.

If the root diameter of the sprocket is larger, for instance, than the theoretical diameter, it will throw the chain out farther from the center of the sprocket, thus making the circular pitch greater. Fortunately, it is not as essential for the pitch of the sprocket and that of the chain, to be exactly alike, as it is in the case of the pitch of two mating gears. In certain cases a slight variation is permissible. It often has been noticed by the agricultural patternmaker, that one sprocket, a little off in its diameter, will cause considerable trouble, which immediately disappears upon correcting the diameter of the sprocket; while another sprocket with a much greater error will run without giving the least trouble. This is true because the sprocket can stand quite a range of variation, if it be in the right direction, but practically none if it is the opposite way. The driver may be larger, but not smaller, while the driven sprocket may be smaller but not larger than the theoretically correct diameter.

Makes the Patterns

Since it is impractical for the foundry to attempt to make castings to extremely accurate size, the patternmaker makes the driver patterns to the correct size, while he cuts the driven patterns undersize from 0.02 inches to 0.03 inches, allowing, of course, the proper shrinkage. With ordinarily good foundry work, the driver castings will range from correct to 0.01 or 0.02 or perhaps 0.03 inches oversize, due to the rap of the pattern and swell of the casting, while the driven casting will be 0.01 or 0.02 inches undersize or up to practically the correct size, from the same rap and swell. It might be mentioned here that a little oversize to the driven sprocket is much more detrimental to smooth running, than a corresponding undersize to the driver.

It is important that the teeth of the sprocket be spaced equally. If the teeth are spaced equally each link gradually slides off the tooth as it leaves the wheel, permitting the following link seat itself properly, even though the pitch of the chain and sprocket do not quite agree. If the spacing of the teeth is uneven, this slight slipping becomes uneven and results in a jerky motion of the chain.

It might be agreed that the pitch of both the chain and sprocket should be made exactly alike. While this might be a desirable condition, it would not be of much value.

The profile of the sprocket tooth is a matter of much less importance to its smooth running than in the case of a gear. However, it is essential that the curve of the sprocket tooth be similar to the path of the chain block as it winds or unwinds on the

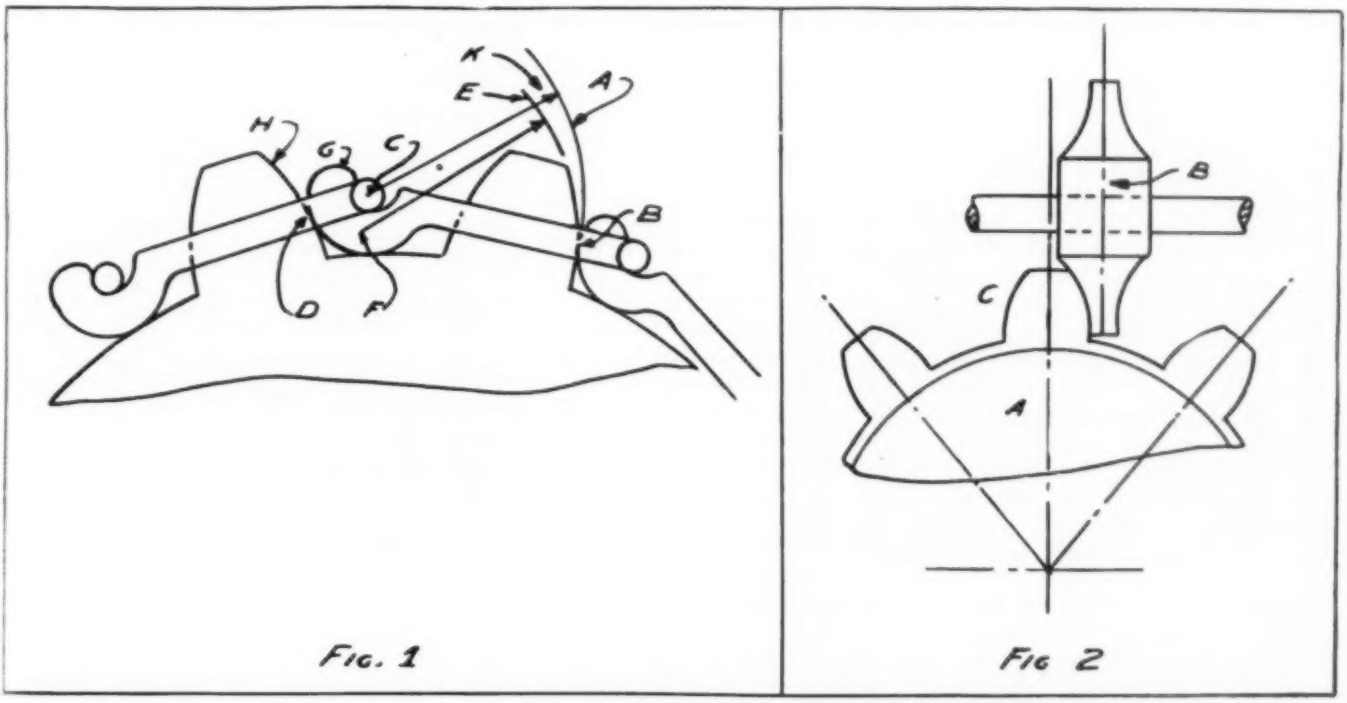


FIG. 1—METHOD OF DETERMINING THE PROFILE OF THE TOOTH. FIG. 2—METHOD OF SETTING THE CUTTER

sprocket, but set with a different center, so as to give a slight clearance, for the gradual creeping, or uptake of pitch errors previously mentioned. In Fig. 1, line *A* is the path of the chain block at its point of tooth contact *B*, as it would naturally lift off the sprocket, swinging from the pivot point *C*, if chain block *G* were properly seated at its point of tooth contact *D* upon tooth *H*. In actual practice this is seldom the case, there being a minute space at point *D*, between the chain block and tooth, until block *B* begins to leave the wheel. For this reason the tooth is made to the profile *E*, allowing a clearance *K*, for permitting block *G* to slide back gradually to its seat at *D*. This profile generally is made by dropping the center of arc *E* down to *F*, about 3/16-inch below *C* on a medium size chain, say No. 55.

From this reasoning it will be seen that accurate spacing of the teeth is important. While there are several ways of making sprocket patterns, the easiest and best way of obtaining the required accuracy of spacing is to cut them upon a gear cutter. It has been found that a 3 pitch No. 3 cutter, when properly set, will make the correct profile for such common sized chain as No. 45, 55 or 62, etc.

After the pattern blank has been bored and reamed to fit the gear cutter mandrel, the outside diameter and sides of the blank are turned upon the mandrel, to insure the pattern being true with the gear tooth cutting.

When the pattern is put in the gear cutter, the first cut is made between the teeth. The center line of the cutter is set directly over the center line of the arbor, as in any spur gear cutting. The first cut is made, to the base or root diameter, this dimension being computed readily on the gear cutter in the regular way by measuring the outside diameter of the sprocket blank with micrometers, and using the thousandths graduations on the gear cutter to obtain the exact depth of cut to the root diameter. This first cut having been made between all the teeth, it is now necessary to "set over" the cutter to get the proper tooth profile. Fig. 2 shows the way the cutter is "set over", *A* being the sprocket blank while *B* is the gear cutter. One tooth *C*, is laid out according to the blueprint upon the face of the sprocket blank. After the proper setting of the cutter is found by a few trial cuts, all the teeth are cut on this side. The cutter is now set over to the opposite side of the sprocket center line, to an amount exactly equal to the offset for the first side cut, this set over being determined readily and accurately by reading the graduations on the gear cutter. The other sides of the teeth are now cut.

There are several methods of obtaining the root diameter, but no way is as accurate as that of actual trial. As many links of the proper chain, as there are teeth in the sprocket being made, are hooked together in a circle, and a wood disk turned of such diameter that the hooked up links can be just nicely pushed on it. This will be the correct root diameter for the sprocket casting, and should be measured accurately with micrometers to give the exact dimension.

This measurement must be altered, of course, for pattern shrinkage. As all the gear cutter graduations are made in standard rule sizes, it will be better to convert the shrinkage sizes to standard rule. For instance, if the pattern is to be made to 9/32-inch shrinkage, for an aluminum pattern for iron final castings, the micrometered dimension of the root circle should be multiplied by 1.0234;—if for a ⅛-inch shrinkage rule, multiply by 1.010417, or 1.01 is accurate enough for medium size pattern.

It will be noted from Fig. 3, that the hook part of the ordinary malleable chain is not made upon a true circle at the radius *A*, but is thickened on the radius *B*. For this reason a sprocket with a small number of teeth, Fig. 4, would require a smaller root diameter than the computed dimension given by the draftsman, figuring the usual way of subtracting *A* from the pitch circle *A*, Fig. 4.

Also, steel chain generally will take

(*Concluded on Page* 936)

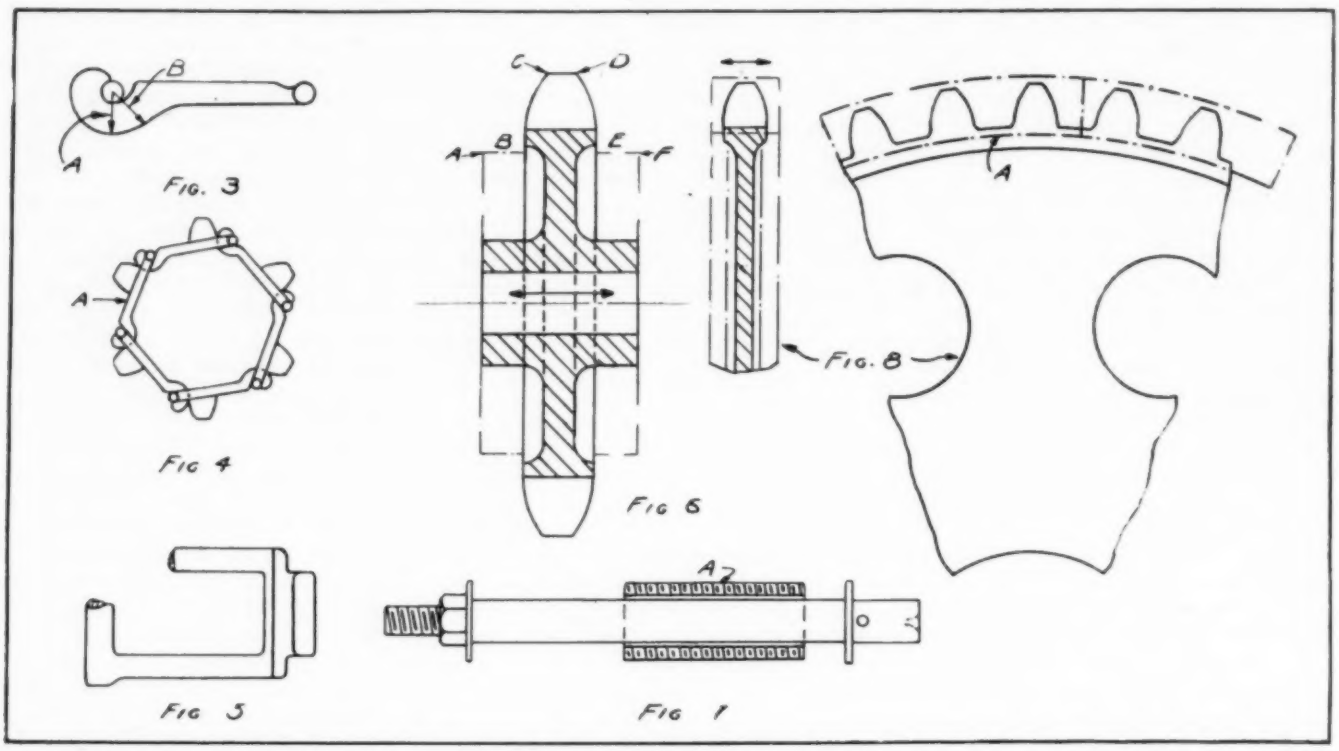


FIG. 3—HOOK LINE OF ORDINARY CHAIN. FIG. 4—SPROCKET WITH SMALL NUMBER OF TEETH. FIG. 5—ONE LINK IS CUT AWAY FOR CONVENIENCE. FIG. 6—ONE PIECE IS USED FOR SMALL PATTERNS. FIG. 7—ARBOR FOR MAKING MORE THAN ONE WHEEL. FIG. 8—GLUED MATERIAL IS USED FOR LARGE WHEELS

The FOUNDRY Family Photograph Album

Upper Left

A. H. JAMESON

Malleable Iron Fittings Co. Branford, Conn.

Lower Left

C. E. BOYD

Dobbie Foundry & Machine Co., Niagara Falls, N. Y.

Upper Right

D. WILLCOX

Ajax Electrothermic Corp., Trenton, N. J.

Lower Right

F. P. THOMAS

Scott Valve Mfg. Co., Detroit

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

HARDNESS OF VARIOUS COPPER ALLOYS

By R. J. Keeley

Name of alloy	Copper	Lead	Tin	Zinc	Iron	Al	Mn	P	Brinell Hardness Number
Bronze	80.00	.....	20.00	.....	.....	.....	.....	Trace	136
Phosphor bronze	79.50	7.50	12.00	.....	.....	.....	.....	1.00	74-80
Phosphor bronze	84.25	5.00	10.00	.....	.....	.....	.....	0.75	60
Tough bearing bronze	85.50 to 86.50	1.00 (max.)	10.50 to 12.00	1.50 to 3.50	0.25 (max.)	.....	0.15 (max.)	.....	90-120
Gear bronze (Stones)	89.00	.....	11.00	.....	.....	.....	.....	.....	80
Gear bronze	89.00	.....	10.50	.....	.....	.....	.....	0.50	72-77
Tough bronze	85.70 to 89.30	0.30 to 0.80	9.00 to 11.00	1.50 to 2.50	.....	.....	.....	.....	80-100
Gun metal	88.00	.....	10.00	2.00	.....	.....	.....	.....	70-75
Bronze	90.00	.....	10.00	.....	.....	.....	.....	.....	65-70
Bronze	90.00	.....	10.00	.....	.....	.....	.....	Trace	67-70
Bronze	88.00	2.00	10.00	.....	.....	.....	.....	.....	65-70
Phosphor bronze	79.75	10.00	10.00	.....	.....	.....	.....	0.25	65-70
Bronze (lead)	80.00	10.00	10.00	.....	.....	.....	.....	.....	55-60
Red brass (lead)	77.00	10.00	3.00	10.00	0.25 (max.)	.....	.....	0.05 (max.)	50-55
Bronze	84.00	6.30	9.50	.....	.....	.....	.....	0.20	59-61
Bronze	88.00	2.00	8.00	2.00	.....	.....	.....	.....	57-59
Free machining bronze	87.80 to 89.80	1.50 to 2.30	7.00 to 7.80	0.40 to 3.40	.....	.....	.....	.....	50-70
Bronze (lead)	81.00	9.00	7.00	3.00	.....	.....	.....	.....	50-55
Bronze (lead)	73.00	20.00	7.00	.....	0.25 (max.)	.....	.....	0.05 (max.)	45
Bronze (lead)	78.00	15.00	7.00	.....	.....	.....	.....	.....	48
Bronze (lead	70.00	25.00	5.00	.....	0.25 (max.)	.....	.....	None	40
Bronze	90.00	1.50	6.50	2.00	.....	.....	.....	.....	50-60
Bronze, red composition, ounce metal	85.00	5.00	5.00	5.00	.....	.....	.....	.....	50-60
Bronze	89.00	3.00	5.00	3.00	.....	.....	.....	.....	40-45
Red brass	83.00	6.00	4.00	7.00	.....	.....	.....	.....	55-60
Red brass (lead)	83.00	10.00	2.00	5.00	.....	.....	.....	.....	34
Reddish yellow alloy	76.00	6.00	2.00	16.00	0.25 (max.)	.....	.....	0.05 (max.)	43-48
Natural color brass	74.50 to 77.50	0.30 to 1.20	0.80 to 1.20	21.00 to 23.00	0.20 (max.)	.....	.....	.....	40-60
Yellowish red alloy	72.00	4.00	2.00	22.00	0.30 (max.)	.....	.....	0.02 (max.)	40-50
Yellow brass	70.00	2.00	1.00	27.00	.....	.....	.....	.....	50-55
Yellow brass	69.00	.....	1.00	30.00	.....	.....	.....	.....	57-59
Manganese bronze	57.75 to 58.25	Trace to 0.20	0.20 to 0.50	38.50 to 39.50	1.05 to 1.35	0.50 (max.)	Trace to 0.25	.....	100-140
Manganese bronze	56.00	.....	0.75	41.50	1.00	0.50	0.25	.....	109-119
Manganese bronze	56.00	.....	1.00	41.00	1.00	0.50	0.50	.....	104-119
Yellow brass	55.00	.....	.....	45.00	.....	.....	.....	.....	80-98
Titanium aluminum Copper	90.00	.....	.....	.....	.....	10.00	.....	.....	90-100
Titanium aluminum Copper	89.00	.....	.....	.....	1.00	10.00	.....	.....	92-96

PROPOSED MASTER SPECIFICATION
FOR FOUNDRY COKE

There are no general specifications applicable to this specification.

Foundry coke shall be supplied in three grades as follows:

Grade *A*, Cupola.

Grade *B*, General Foundry, large.

Grade *C*, General Foundry, small.

Coke shall be well screened and shall not contain large particles of slate, ashes, or foreign matter.

Coke shall be sound and uniformly coked.

Respective grades of coke shall have chemical properties shown in the accompanying table when sampled at the ovens.

Grades	Fixed Carbon Minimum	Ash Minimum	Volatile Matter Maximum	Moisture Maximum	Sulphur Maximum	Phosphorus Maximum
A	88.0	10.0	3.0	2.0	0.75	0.030
B	86.0	12.0	3.5	2.5	1.00	0.040
C	84.0	13.0	4.0	3.0	2.0	0.040

Respective grades of coke shall have the following physical properties:

(*a*) Size: Grade *A* and *B* coke shall all be retained on a 2½-inch screen.

Grade *C* coke shall all pass through a 2½-inch screen and be retained on a 1¾-inch screen or fork.

(*b*) Cell space: The volume of cell space shall be as follows: Grade *A*, 45 per cent; Grade *B*, 50 per cent.

(*c*) Shatter test: The weight of coke remaining on a 2-inch screen after being subjected to the shatter test, shall be as follows: Grade *A*, 80 per cent; Grade *B*, 70 per cent.

A sample shall be taken from each car load or its equivalent as outlined in American Society for Testing Materials' Standard D17-16.

Chemical analyses and physical test will be made as follows:

(*a*) Chemical analyses, American Society for Testing Materials D37-24.

(*b*) Cell space, American Society for Testing Materials D167-24.

(*c*) Shatter test, American Society for Testing Materials D141-23.

Screens or forks used for determining size of coke shall have rectangular openings.

Coke shall be packed for shipment as required in the invitation for bids.

A ton of coke shall consist of 2000 pounds.

Grade *A* coke is suitable for cupola melting where a high grade iron is desired. Grade *B* coke is suitable for general foundry purposes, and for cupola melting where the highest grade of iron is not desired. Grade *C* coke is a small coke for general foundry heating purposes.

Abstracted from a proposed United States government master specification promulgated by the Federal Specification board, Washington.

Bill Has a Few Words To Say on Rings

By Pat Dwyer

YOU are so deeply interested in the doings of high society," I said to Bill the other night, "I wonder what you thought of the account of a recent wedding in which the statement appeared that the bride amended the usual formula by omitting the word 'obey'."

"If every one was as little interested as I am in high society's temporary weddings," Bill replied, "the canny newspaper boys would condense the accounts into three-line items and use them for fillers on the sport page. For example:

Today in front of 600 fans, John Doe and Mary Roe stepped into the matrimonial ring. The bout is scheduled to go an unlimited number of rounds. The bride appeared to be in the pink of condition, but the groom seemed to be slightly over trained. The betting is 6 to 4 that Mary will win by a knockout before six months.

"There y'are," Bill continued, "the whole story in a few lines of type with a little prophecy thrown in for good measure. Marriage is the oldest institution in the world and with comparatively few exceptions, every person who attained the age of 30 has been through the mill at least once. Every year in the United States alone, several million Romeos promise to love and cherish an equal number of Juliets and endow them with all their worldly goods. A month after the marriage, when the first batch of bills comes in to the love nest, Romeo brutally inquires, 'Hey, you. What do ya think ya married, a bank?' Juliet, in her veil and orange blossoms trips up to the rail, a vision of delight to the groom, mercifully in a state of suspended animation. also a vision of delight to her fond parents who realize that now she is off their hands they can make a payment on a new car. Her eyes are cast down modestly, but the eyes which every woman carries in the back of her head catch the envious glances of her dear girl friends and her cup of happiness is filled to the brim. She is not in a state of suspended animation. With a cute little tongue in one delicately painted cheek and a chew of gum in the other, she bravely promises to love, honor and obey Romeo until death do them part. A few weeks after the ceremony which made them one she stands firmly in the middle of the floor with arms akimbo and pointedly inquiries, 'Who do ya think yer trying to boss around, ya big bum?'"

"You are taking in too much territory," I said. "Also you are wandering away from the point at issue. I referred specifically to the action of one of the members of the ruling klauss in refusing to recognize the word obey. Quite probably in her mind the word was associated with the proletariat. Common people who vulgarly earn their own money instead of drawing it from an inexhaustible supply in a bank. People, my dear, with absolutely no conception of the fine art of doing nothing, but who spend the greater part of their time in stuffy offices and indescribably filthy workshops. They think nothing of wearing the same suit for an entire season, and 'tis said—however incredible it may sound—that they never even think of paying a visit to a manicurist."

"Well," said Bill, "I'll tell you. Maybe you are right and then again on the other, or right hand, maybe you are just shooting hot air through your bonnet. The word obey never should have been placed in the marriage declaration. If a woman is so minded she will live peaceably with a man without any marriage ceremony. If not—well—forty marriage ceremonies and a repetition of all the words in the dictionary will not insure obedience, or even toleration. The average man feels bound morally to live up to the letter and spirit of a contract. The average woman mentally reads a clause of her own into every contract, 'Subject to change without notice.'

"Marriage is a gamble into which men and women enter blindly or with their eyes shut. They stake their entire future happiness on a brief oral promise and the transfer of a $4 gold or near gold ring from the vest pocket of the groom to the third finger on the bride's left hand."

"Dear lad," I said, "you are overlooking one important point. The ring is symbolical of eternal constancy. Hallowed by tradition and custom it is anchored deep in the rock of convention. Convention, my boy, more than any other single factor is what keeps people from climbing over the barrier."

"Anchor or no anchor," said Bill, "it is a pretty slim holding device on the end of a mooring line when the old domestic ship is plunging in a matrimonial storm. Symbolical of constancy, hey? How about the rings these what-do-you-call-'ems wear in their ears and noses? What about the ring in a bull's nose or a pig's snout? According to—presumably—

BOYS WILL BE BOYS, BLESS THEIR LITTLE HEARTS

authentic accounts which come floating back from the far parts of the earth, one of these sooty gents with a ring in his nose, will change a wife as readily as he will change his shirt. In fact more readily. He has no shirt, but apparently he always has a string of wives on hand which he is willing to turn in for new models. The bull may serve as a model for strength, courage, fortitude and endurance but if any person tells you he (the bull, not the speaker) is a monogamist, why, that is simply more bull. Rings!" Bill snorted in derision. "Why, you poor gommoch, a ring has more applications than a hottentot has wives. Did you ever hear of a circus ring, a bull ring or a ring around the moon? How about fairy rings, ring worms and ring-around-a-rosy? You must have heard of political rings, the fisherman's ring and the ring of the front door bell. Then there are ring down the curtain, ring out wild bells and curfew shall not ring tonight. History fairly drips with poison rings, signet rings and rings of conspirators. A nasal wail from tin-pan alley pleads with some one to 'Ring Me Up Some Rainy Afternoon.' Emily Post does a chapter on napkin rings. The furniture men can talk for an hour on curtain rings and at every summer resort you can get three rings for a dime, to throw at impossible prizes on a board. Instances are innumerable. Think of Ring-ling Bros. circus; The Ring and the Book and the Fatal Wedding Ring. Don't forget ring-bolts, ring doves and the far-famed ring-tailed roarer, also ear rings, ringlets, ring leaders and sounds in the ringing rocks. What about the ring into which all the hats are thrown, the high water ring on the small boy's neck, the inside ring and the prize ring? I suppose you have heard of such a thing as a key ring, ringing in a cold deck and a dead ringer.

"The old memory ain't what she used to be," Bill reluctantly admitted, "but if I had a little more time I could run rings all around that silly theory of yours about the ring and constancy."

"Pray do not let me detain you," I said, "if you are in a hurry to go. However, there is one question I should like to ask before you hop off. Have you ever worn a ring?"

"Well," said Bill, "yes and no."

"What do you mean, yes and no?" I asked. "Either you have worn a ring or you have not worn one. I suppose you are going to ring in some quibble about a sweetheart who gave you a ring and then died. You hung it on a wisp of spunyarn around your neck. Abrasive action of sweat and sand eventually wore away the cord and the ring disappeared. Since then you have worn no other."

"No," said Bill, "none of my sweethearts ever gave me a ring. One of 'em gave me an umbrella, but I took that as a hint she thought I was all wet, so I quit. Maybe she thought she was putting something over on

NOTE: RING ENLARGED FOR PURPOSE OF IDENTIFICATION

me, but I hocked the thing for $2 and lost the two the same night shooting craps with Tim (Peg-leg) Donovan. Say! There was a bird with only one leg and he could hold more beer than if he was a centipede with a hundred legs, all hollow. I'll never forget the time him and Denny Egan—may his soul rest in peace—put on a beer drinking duel in Lynn. You know, Denny held the undisputed beer drinking championship of New England for time out of mind. Oh, long before the Light was started—"

"Never mind about Denny," I interrupted, "to slightly paraphrase the famous old poem, 'His bones are dust and his good sword rust and he's gone where it's no harm to have a thirst.' Furl the old banners of bygone days and let him rest. What about this ring you wore and did not wear?"

"Well," said Bill, "I was just going to tell you about that. I wore an aluminum ring for a short time. A ring that I made, myself, more as a show-off gesture than because I wanted the thing. Certainly I never thought it enhanced my manly beauty and most assuredly it conveyed no false impression of my financial standing. I wore it on the fourth, or careless finger, of the left hand and therefore no observer could attach any sentimental significance to it."

"If you had no earthly reason for wearing the silly thing," I asked in exasperation, "what in the name of Judas Iscariot's ear rings, did you wear it for?"

"In the days of my youth," Bill continued calmly, "I was innocent and easily led. Sometimes now when I think of 'em, I blush at some of the things I did, for no other reason than because others were doing them. Against my better judgment I ordered a suit with long tails to the coat at a time when I was 17 years of age, 6 feet high and about 14 inches—at a generous estimate—across the shoulders. I felt then, and I know now, that I must have resembled one of these here now grasshoppers. I tried to grow a beard one season, but the effect was rather discouraging. Did you ever see a dog in an advanced state of the mange? I merely mention these instances to explain why I was led into wearing a ring. Some one in the open hearth—probably the millwright's helper—laboriously carved a ring for himself out of a hunk of aluminum. One or two other lads followed his example and then in the mysterious manner which news filters through a mill, every one gained the impression that an aluminum ring was a sure preventative of rheumatism.

"The hunkies in the pits were the last to catch the infection. They developed a technique of their own. One would come creeping up out of the pit, feet wrapped in pieces of gunny sacks in lieu of socks, and lurk around the nearest pouring platform until a small piece of aluminum missed the top of an ingot mold and landed on the ground. At the risk of a splash from a leaky stopper or a bursting mold, the lad would dart forward and retrieve the precious particle. Later, when he saw a locomotive with a drag of hot metal ladles entering the mill he placed the piece of aluminum on the rail where the weight of the locomotive and ladles flattened it out to the desired thickness.

"At first they bored a hole in the

center and carved away the metal on the outside with the formidable knives usually employed in carving and conveying garlic filled sausage, raw onions and other 'ver' mooch good' food into their capacious maws. Later they began to filter into the quick test laboratory where the attendant obligingly drilled the aluminum in answer to the plea 'Boss man quick, please poke hole in 'im, ya?'

"The spectacle of so many men wearing rings started one of my fingers itching to wear one. The idea of laboriously gnawing away a hunk of aluminum did not appeal to me. 'Surely,' sez I to myself, 'there must be an easier method.' I decided to cast a ring.

"Then I had a brilliant inspiration for boosting the pin money account. I borrowed half a dozen gold rings from lads around the mill. Rings with fraternal emblems and letters, one with a miniature belt buckle and another with snakes intertwined. Rings with some class to 'em. I strung them ¼-inch apart on a piece of ¾-inch stock core and made a mold. The rings were removed from the core and returned to the owners. The core was replaced in the mold. Then I stuck a couple of hunks of aluminum in a test ladle, shoved the ladle through the little round peep hole in a furnace door and melted the metal. I poured the rings and then displayed them to all and sundry. Before the day was over I had orders for 100 at a flat rate of a quarter each and I had visions of clearing up enough in a short time to enable me to retire for the winter. However, you know there always is something to keep the bear's tail short. Some degenerate scut told the old pot-bellied super about the racket and he told me that if he caught me pinching any more aluminum, he would fit me up with a ring around the ankle with a nice ball and chain attached to it.

"Probably he was exaggerating, but I was young and innocent in those days and regarded a superintendent as something only a trifle less than a deity. I kept one of the rings with a belt buckle on it for a souvenir and wore it for a short time. One day while driving a clamp on a flask I accidentally hit it a belt with a hammer. Instead of proving a protection it bit into my finger like a rat trap. I filed it off and threw it away. No more rings for me.

"Talking about rings reminds me of an inquiry I had from a lad one time who said one of his customers wanted him to cast a gray iron rim ⅞-inch thick, 2 inches high around the top of a sheet steel casing approximately 2 feet square. The casing was made from ¼-inch steel plate designed to project into the center of the gray iron rim for a distance of ½-inch. The joint must be oil tight.

"It was a kind of an odd proposition and I told him that I did not think the problem he had set himself was within the range of practical solution. Casting a rim around the top of the casing is comparatively simple, but making the joint oil tight is something of an entirely different character. With only ½-inch space on either side of the steel insert, the metal will set long before the steel is raised to a welding temperature. Natural contraction will cause the iron to grip the steel tightly, a few holes punched in the plate will anchor it firmly but the joint will not be oil tight.

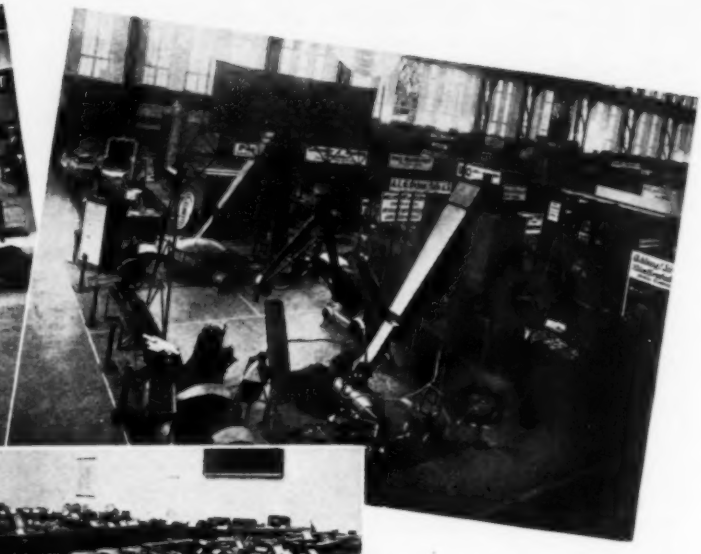
"If the customer is willing to pay for the extra time, material and risk involved I suggested he should try the following method: Tin that part of the casing to be covered with iron and dry it thoroughly before assembling the mold around the top of the rim. Arrange a flow-off on two opposite sides that will keep the mold drained to the level of the top of the steel casing. Place a runner on each of the remaining sides. Catch two hand ladles of sizzling hot metal from the cupola spout and pour about half the contents into the mold, allowing the metal to run out through the flow-offs at the sides. Then plug the side holes and fill the remainder of the mold with the remainder of the metal. This must be done without any cessation of the stream of metal from the ladles. Unless the metal in the mold is kept in motion, the resulting casting will show a streak, or cold shut at the stage where pouring temporarily ceased. The tin coating on the plate will unite the iron and steel firmly. Several methods are available for forming the mold. The best method will depend on local conditions and on the number of castings required. The simplest method is to make a wood frame the size and shape of the rim with a slot in the bottom to accommodate the top of the steel rim. A shallow flask is propped up around the casing and the mold is made in the usual manner. When the pattern is withdrawn the top of the steel casing will be found projecting up through the bottom of the mold. A better method is to invert the casing and enclose the lower rim in a set of cores. This method also will increase the probability of the iron sticking to the steel to form an oil tight joint. In this instance several pop risers may be arranged along the highest edge of the casting or cores and the iron can be kept flowing through until the ladles are emptied. A bank of green sand packed around the cores will hold them in place.

PHONE WILLIAM HE MIGHT SEND HIS TRUCK FOR IT

"Another angle to the situation," Bill continued, "and one that I forgot to mention is the doubtful feature of contraction. I am afraid that the cast iron rim will crack. The only way to find out is to try the experiment. I never have tried that particular experiment, but I have tried others of a somewhat similar character and they all were failures. Molten iron will stick to steel only under the most favorable conditions and the conditions presented by my correspondent are anything but favorable.

(*Concluded on Page* 942)

(Above) — Conveyors and molding machines at the German foundry exhibition. (Right) —A display of pattern equipment



(Above)—A typical view of machinery hall. Equipment shown includes sand slingers and sand treatment machines

Dusseldorf Exhibition
Features Economy in Practice

UNDER the title "Economy in Foundry Practice," the fifth foundry exhibition organized by the German Foundry Owners' federation was held in Dusseldorf, Sept. 4 to 22. The exhibits were housed in the exhibition hall attached to the Municipal and National museums in the Hofgarten on the Rhine. The exhibition comprised a technical and educational section with a small hall for the model foundry in operation, and a commercial section of 100,000 square feet for the machinery in operation. The commercial section was not as comprehensive as might have been expected, at least ten of the leading equipment manufacturers not being represented. Two foundry exhibitions already had been conducted in Europe this year, one in London and the other in Prague.

The technical and educational section was most complete and demonstrated that the application of modern science and engineering is resulting in economy and improved production in all phases of foundry activity. This section was designed to show the development of modern methods in production of castings. In Germany the price of raw materials for the foundry is controlled by the large commercial syndicates, while wages are controlled by the national wages board. Therefore, it behooves the foundryman to improve his practice if he is to succeed in reducing costs.

The technical exhibit was organized by the Union of German Ironfounders under the management of Dr. Ing. Th. Geilenkirchen. Developments of the last 30 years in molding machine technique and of the last six or seven in melting practice and mold drying were clearly shown.

Historical Models Shown

Outside the exhibit hall was mounted a manganese-bronze propeller weighing some 2 tons and a 3-ton copper casting for a hot-blast gate. In the entrance hall a number of models depicted foundries from 1500 up on 1890 when the first molding machine and conveyor were introduced. Models and diagrams representing the development of the foundry plant from 1700 up to the present time included foundry design and ventilation, laboratory and welfare activities. The mechanical testing section featured testing machines for all tests on cast iron including the recent work on the shear test (ring method) and the influence of test bar size on the transverse strength.

Complete equipment for chemical analysis of foundry material was shown, specimen laboratories for cast iron, fuels, etc., being erected. Microscopes and equipment for polishing and etching were displayed as well as a large number of photomicrographs showing graphite size and shape. Charts illustrated the various equilibrium diagrams for the iron, carbon and silicon systems. Pyrometers and apparatus for thermal analysis also were on display. Apparatus for shrinkage determinations, gas solubility, conductivity, corrosion, etc., were shown, and a Fuess apparatus for spectroscopy. The X-ray section comprised an exhibit dealing with the scientific application of X-rays for the examination of the crystal structure of metals, and an exhibit by the German State Railways on the X-ray testing of castings for blowholes and cracks.

The standardization movement in Germany has reached foundry practice, and cast iron as an engineering material is classified into four grades, from common iron up to a high-quality material. These were shown in typi-

cal analyses, microstructures, fractures and test results for each grade of material. Similarly standardized malleable cast iron, both European and American, and annealed gray cast iron were illustrated by means of samples, microstructures, test results, etc. An interesting group showed the various types of defects in malleable castings. Here again the German standard classification (D.I.N.) has been adopted. An important phase in castings production is the design of the casting, and the Union of German Ironfounders has drawn up a number of regulations on the correct design of castings.

German standardization authorities have been at work in the pattern shop, and a complete exhibit was shown of the recommended standard methods for pattern materials and design. Examples were on view of right and wrong methods of pattern construction.

Apparatus for conducting molding sand tests for grain size, moisture, permeability and strength was demonstrated. Some of the American Foundrymen's association tests have been adopted in Germany, but the tests do not appear to be so suitable for the naturally-bonded sands as compared with synthetic sands. Sand preparation was illustrated by models of equipment and all the tools and methods of hand-molding, loam and strickle molding and core-making were shown. Working models showed the development of various types of molding machines, and the recently-published experiments on ramming density with different types of molding.

Much work has been done in Germany on mold and core drying, and models were shown which compared the old and the modern methods. In the fettling section the old methods showed a remarkable comparison with the new. The tumbling barrel appears to be losing favor in place of the sandblast table and, more recently, the water spraying method. Treatment of castings by enameling, rust-proofing, metal-spraying, etc., was shown.

Linked with Production

One exhibit showed that to obtain 1 ton of castings it is necessary to move from 15 to 20 tons of material. The question of foundry transport is connected closely with production methods, and the German view appears to be that "continuous flow" methods are applicable only under modified conditions. The bank conveyor or similar equipment is not in use in Germany, except as for auxiliary plant such as sand-preparation plant. Raw materials, recovery of waste materials, types and operation of cupolas and air furnaces, ladles and cranes all were shown.

In the model foundry it was endeavored to illustrate how economy can be effected on the "continuous flow" principle. In one set of operations the molds were made on a machine and placed on a table alongside a vibrating conveyor. The molds were poured and then knocked out upon the conveyor, the castings proceeding straight on to the fettling shop, the sand being taken up by the sand-treatment plant and after suitable treatment redistributed to the molding machines by electric trucks. The other set of operations consisted of a gravity roller conveyor on which the molds were placed for pouring. The empty flasks were sent down a return conveyor after knocking out at the far end.

In the same hall as the model foundry a large-scale working model of the Citroen foundry in Paris was shown. A number of exhibits showed the methods of training apprentices and the psychology tests carried out to determine ability.

Equipment Is Diversified

Some 160 manufacturers exhibited in the commercial section of the exhibition, but the bulk of the exhibits were of supplementary equipment. Some half dozen companies showed molding machines, both hand-operated and pneumatic. The A. G. der Eisen und Stahlwerke of Schaffhausen showed a variety of machines. The Universal-Werkzeugmaschinen und Apparatsbau of Koln-Ehrenfeld exhibited an interesting machine using double-sided patternplates with snap flasks. The small machines were lever-operated, while the larger machines were pneumatic. The machines were of the roll-over and pattern-draw type. A feature of the exhibits was the sand-preparing and handling equipment. F. K. Axmann of Koln-Ehrenfeld demonstrated several sand-throwers and sieves and a sandslinger of the centrifugal type. This firm also showed an electrically-operated molding machine with pattern-plates. A sand-cutter and a sand-preparing machine were shown by Peter Hammers of Karlsruhe. The booth of Alfred Gutmann of Altona-Offensen exhibited sand-blast equipment of the table and barrel types, and a mold-dryer with an electric fan. H. Pollems of Gladbach and several other firms also showed this class of mold-dryer. O. Ullrich, of Leipzig, showed a good range of sand mixers, sieves and separators.

A selection of gas and oil-fired furnaces for nonferrous and ferrous melting was exhibited by Dr. Schmitz & Co. of Barmen, but the most interest was aroused by the Brackelsberg and Buéss furnaces for melting cast iron. These two furnaces are of the drum type, the Brackelsberg furnace being horizontal and the Buess furnace being inclined at an angle. The former furnace is fired by coal dust and the latter by oil or coal dust. The furnaces rotate or rock slowly during the melting operation, there being a slag layer to protect the metal from oxidation. It is claimed that high-quality white-heart malleable castings can be produced from this type of furnace at low melting costs.

A pneumatic core remover made by the Titan Maschinen Co. of Duesseldorf consisted of an arm shaped to fit the casting to be fettled, which was vibrated rapidly by means of a pneumatic piston. There was a good exhibit of testing machines, microscopes and chemical laboratory apparatus by several firms, which serves to show the extent to which laboratory control is adopted in Germany. An interesting device on the stand of the Duesseldorf Municipal Gas Department was a machine for welding blow-holes. The various coils of welding wire of different metals and alloys attached to the machine made the machine rapid and flexible in operation.

Smoothing Wrinkles in Stove Production

(*Concluded from Page* 902)

they are nickel plated and afterward buffed and polished. Tops for coal burning stoves are assembled complete with all the covers and rings in place and then placed on the table of a grinding machine, designed to travel longitudinally and laterally under a grinding wheel. This operation imparts a perfectly flat surface to the entire top of the stove.

Iron for the castings is melted in a cupola made by the Whiting Corp., Harvey, Ill., and lined to 44 inches. The daily heat in the busy season is approximately 20,000 pounds. A smaller cupola erected many years ago still stands close to the first cupola, but it has not been used since the larger cupola was installed.

Charges for the cupola used are made up of 2000 pounds of iron and 180 pounds coke. Component parts of the iron charge vary from time to time depending on market conditions and available supply of materials, but they are adjusted to yield the following approximate analysis in the castings: Silicon 2.50 per cent, sulphur 0.08 per cent, phosphorus 0.70 per cent, manganese 0.50 per cent.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of THE FOUNDRY or of its editors.

TO THE EDITORS:

In the Sept. 1 issue of THE FOUNDRY on page 749 an inquiry was made on the warping of glass molds under the heading, "Glass Molds Warp." Since the writer has had some experience in this field, he believes that a few comments may be of interest to other readers. In one case electric furnace iron was tried in place of cupola iron. The mold makers believed at first they could not machine the electric furnace iron as they were accustomed to machining extremely soft, cupola iron with a brinell hardness around 140 while the electric furnace iron ranged from 180 to 190. However, they found, much to their surprise, that although the iron was tougher and required more power on the lathe, it could be cut just as fast as the softer cupola iron.

Another advantage was gained with this iron in that they desired a mold that would hold the polish on a rapid bottle making machine. The old molds only had been holding their polish for 4 hours. With electric furnace iron, the molds held the polish at least 6 times as long. Another feature surprising to the operators was that the new molds did not warp and show fins on the glassware as had been the case with the other molds.

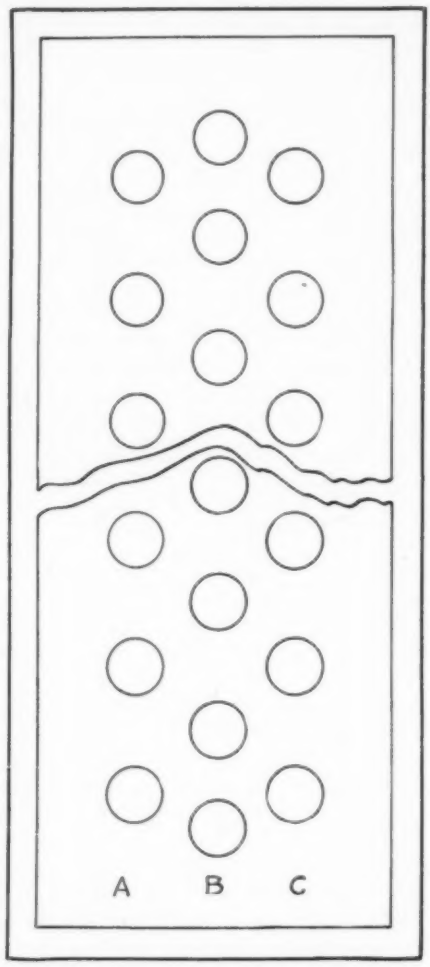
W. HARVEY PAYNE
Chicago Foundry Service Co.
Chicago

ImprovesMoldingMethod

TO THE EDITORS:

In a recent issue of THE FOUNDRY J. H. Eastham describes the pattern, mold, cores and casting for a flange block 4 x 8 feet and 3½ inches thick, pierced by 252 holes each 1⅝ inches in diameter. The job was carried out under the most primitive and economical conditions and the cost of the pattern was held to a minimum by making a plain box with the 252 prints fastened to the bottom. This pattern was placed on a level sand bed and tapped lightly to secure an impression of the prints. Then the pattern was removed temporarily while the prints were pierced to the necessary depth with a brass sprue cutter. The pattern then was replaced and the remainder of the mold formed in the usual manner.

As a slight improvement on this method I suggest a plain frame without top, bottom or core print. This frame is placed on a level bed and the sides and ends of the mold are formed in the usual manner. A plain board 6 inches wide, 4 feet long is prepared as a templet by boring three rows staggered holes in it to correspond to the required holes in the casting and as shown in the accompanying illustration. The pattern is removed from the mold and this



TEMPLET FOR LOCATING COREPRINTS

board is placed flat on the bottom face of the mold close to one end. The same sprue cutter is employed to project the holes in the board into the sand the required distance, in this instance 1½ inches. The board then is carried forward until the row of holes marked *A* in this instance coincides with the row marked *C*. A neat fitting wood plug is dropped through each of the end holes in the board into the corresponding core print in the sand. These plugs will hold the board accurately in place while the molder is punching new core prints through the openings in the rows marked *B* and *C*. The process is repeated as many times as may be necessary to place prints over the face.

J. N. ALLENBY

Make Cast Iron Rings

TO THE EDITORS

In a recent issue of your interesting publication there was an article under your uses of castings with reference to cast iron manhole covers. The article speaks of manholes generally and mentions the fact that cast iron is used in the cover.

It would seem from this article that you have not as yet been advised of the fact that cast iron rings have for some time been used in manhole construction, supplanting the old brick type construction. The use of cast iron manhole rings reduces the cost very materially and saves considerable time. It opens up an excellent field for gray iron which, heretofore, has not been available.

ARTHUR J. TUSCANY,
Manager
Gray Iron Institute,
Cleveland, O.

Receive Appointments

R. E. Kelley, formerly manager of the Boston office of the Independent Pneumatic Tool Co., Chicago, and John Ashton, formerly salesman in the New York territory for that company, have been appointed sales engineer for the Eastern district, with headquarters in New York, and manager of the Boston office, respectively.

Sprocket Patterns Made on Gear Cutter

(*Concluded from Page* 930)

a different size sprocket than malleable chain, though they are said to be interchangeable.

From these reasons, it will be seen that it is much safer to obtain the root diameter by making a trial disk, the work of but a few minutes, than any other way. For convenience in hooking together a small number of links, one link should be cut out as shown in Fig. 5.

In production work sprocket castings generally are made from aluminum matchplates. In the case of the smaller sizes, where more than one casting is made per flask, it usually is customary to make a wood master from which the required number of white metal castings are made, these being filed, or otherwise smoothed.

A better way is to cut as many wood masters as required directly upon the gear cutter. This eliminates the errors due to the casting and the finishing of the white metal patterns.

Contrary to the general opinion among wood patternmakers, the standard machinist gear cutter will make a

remarkably smooth and accurate cut upon wood patterns, the only requirement being that the cutter be run approximately with the grain in the wood piece being cut.

For small patterns, one solid piece of wood should be used with the grain running in the direction of the arrow in Fig. 6. The center hole first is bored and reamed with a shell reamer, and then turned upon an arbor which will fit the gear cutter. Instead of finish turning the pattern at once, it is only turned on the rim, line *ABCDEF*, Fig. 6. The pattern is taken out of the lathe at this stage and the teeth cut. The extra stock at *AB* and *EF* gives a rigidity to the pattern which is a convenience when cutting the teeth. After the teeth are cut, the arbor is returned to the lathe and the turning finished.

As many sprockets as are required for the matchplate may be cut at one operation, by stringing them all on one long arbor. Fig. 7 shows an arbor for this purpose. *A* shows an aluminum sleeve used when cutting a lesser number of sprockets.

In making larger sprockets, where the pattern has to be laid up in segment work, the blank is turned to an outside diameter about ¼-inch less than the root diameter *A*, Fig. 8. Upon this diameter is glued the material for the teeth, in segment form, but with the grain of the wood running across the face of the sprocket. In this way the cut will be running with the grain both at the sides and at the bottom of the teeth. Like the smaller sprockets, the large ones are left unturned below the root diameter for stiffness in cutting.

When making matchplate patterns, the parting should follow over one side of the tooth, that is, the whole tooth should be molded in the drag, and not split parted on the center line so as to leave half the pattern in the cope and half in the drag. When made in the latter way the slightest shift in the mold will leave an unsightly ridge down the center of the casting, while a slight shift in patterns made the former way scarcely will be noticeable.

Ohio Foundrymen Meet at Toledo

THE first sectional meeting of the Ohio Foundries Association, Inc., held at the Toledo Yacht club, Toledo, O., Oct. 10, was highly successful from the standpoint of attendance and interest displayed. Approximately 100 members of the association, composed chiefly of foundrymen from the Northeast section of Ohio, listened to the papers presented on several phases of the industry and took part in the discussions. The Toledo meeting was the first of a number of gatherings which will be held in various sections of Ohio during the year. Selection of the cities in which the quarterly meetings will be held, has been left to the officers. The sectional meeting will be held at Dayton, O., in January.

President C. C. Smith, Toledo Steel Casting Co., Toledo, called the meeting to order immediately after a special luncheon, and welcomed the members to Toledo. Carl Cotter, head of the vocational department of the Toledo public schools, then described the work that is being done in providing vocational education for high school students. He asked for the cooperation of the association in providing a comprehensive plan to assist the young man in choosing his life work.

L. P. Robinson, Werner G. Smith Co., Cleveland, in a talk entitled "What Has Become of the Foundrymen's Share of the American Dollar", pointed to several ills that exist in the industry. He attributed these to the following factors: Lack of definite knowledge of foundry costs, improper selling methods with unrestrained and unintelligent competition, failure to study customers needs and to stress quality and service, encroachment of other materials as substitutes for castings, quoting on a flat price basis, taking tonnages at a price which will not permit a profit, lack of co-operation between foundrymen and lack of organization.

"Advances in Foundry Practice" was the subject of a talk by E. J. Lowry, consulting metallurgist, Detroit. Mr. Lowry spoke of the need for definite specifications governing strength, hardness and ductility of gray iron castings. He described methods of testing sand, and told of the progress that has been made in the design of the cupola, temperature control, preparation of the mold and in materials used by the industry. He also spoke on the various types of test bars in use in this country and abroad.

After reports of the president, treasurer and secretary, the following members were elected to the board of directors for a term of three years: George H. Alten, Alten's Foundry & Machine Works, Lancaster, O., A. H. Kramer, Advance Foundry Co., Dayton, O., J. H. Bruce, Bowler Foundry Co., Cleveland, D. I. Miller, James B. Clow & Sons, Coshocton, O., and P. S. Horton, Wilmington Castings Co., Wilmington, O.

Immediately following the close of the meeting, the board of directors met and elected the following officers: President, Don McDaniel, Hamilton Foundry & Machine Co., Hamilton, O.; vice president, George H. Alten, Alten's Foundry & Machine Co., Lancaster, O.; treasurer, Charles Seelbach, Forest City-Walworth Run Foundries, and secretary-manager, Elmer F. Scott, Penton building, Cleveland.

DON McDANIEL

GEORGE ALTEN

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
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PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶ Basic Facts Needed

ASK any foundryman, whether he operates a large shop with an annual output running into thousands of tons or whether he has a few brass pots or a single cupola, if his accounting methods are reliable. Ask him whether his bookkeeping gives him a true picture of his business. His answer almost invariably will be that his accounts are accurate and his methods unassailable. At least fifty per cent of the time, he is wrong.

THE federal income tax law has made better bookkeepers out of many business men. Sad experience, in time, may through the open door of the bankruptcy court awaken others to the inadequacy of present methods in many establishments. Sound accounting, and more than that, uniform accounting methods are basically imperative as the foundation upon which to erect a structure of accurate costs and next to uniform cost methods. Trade associations in the foundry industry have taken the initiative toward uniform, intelligent accounting methods. The next step is up to each individual foundryman. Get in line with progressive industry.

¶ Rules of the Roads

ONLY a few years ago, the government was viewed with apprehension by the first trade associations which were attempting to pioneer the path to better business in various industries. Today, according to Dr. Hugh P. Baker of the chamber of commerce of the United States, speaking at the annual meeting of the Gray Iron institute, the government attitude is sympathetic and helpful. As long as a trade association observes the rules of the road and its members show good sportsmanship in competition, no obstruction will be encountered in the road ahead.

THE rules of the road are simple. A trade association may not fix prices nor discuss prices, but it can discuss many factors entering into the price structure of its commodities. Such an organization cannot curtail production, but it may compile statistics and facts on production which can be presented without comment or interpretation. A trade association cannot allocate sales territories or customers and cannot distribute credit information on customers in such form as to constitute a blacklist. Good sportsmanship is the rule, rather than the exception in American business today. Accordingly, the track is clear for increased usefulness and greater service by the strong trade associations that have been formed throughout the foundry industry.

¶ Should Increase Tonnage

THE automobile for the first six months has usurped the place that cotton has occupied since the Civil war as leader of the export trade, according to a recent bulletin issued by the chamber of commerce of the United States. That organization's report shows that export of automobiles, parts and accessories for the first part of the year totaled $339,160,000, an increase of 36.4 per cent over the same period in 1928.

HOWEVER, automobile exports is not the only item that has advanced. Export of agricultural machinery and implements gained over 33 per cent; electrical machinery and apparatus, nearly 28 per cent; power-driven metal-working machinery, 41 per cent; oil well machinery gained over 81 per cent and mining and quarrying machinery gained 21 per cent. The bulletin also stated that finished manufactures constituted 52.3 per cent of the exports in 1929 and accounted for 97 per cent of the export gain which was 10.3 per cent greater in the first half of 1929. Increased shipments of machinery, automobiles, iron and steel manufactures were responsible largely for the showing of that group.

SIGNIFICANCE of these statements should be plain to the foundryman. Practically all of the items mentioned use many castings and the total value of those embodied in the automobiles and machinery that have been exported would be enormous. These figures indicate the fact that foreign countries are interested in American products and will require those which gained in export. Other countries are becoming convinced of the practicability of American methods of manufacture. Tonnage of castings required for machinery, automobiles and automotive parts should increase as the exports in those fields rise. That means more business for foundrymen.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

JAMES F. CROFT resigned recently as metallurgist of the Mackintosh Hemphill Co., Pittsburgh, to become identified in a similar capacity with the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. He is in charge of the roll department. For several years Mr. Croft was located at the Fort Pitt plant of the Mackintosh Hemphill Co. In 1922 he was transferred to its Garrison plant. He was born in Pittsburgh in 1893 and before becoming affiliated with the Mackintosh Hemphill Co., he was identified with the Mesta Machine Co., West Homestead, Pa., and the Crescent works of the Crucible Steel Co., Pittsburgh.

S. S. Wrightson, joint managing director, T. Summerson & Sons, Ltd., of Darlington, England, accompanied by William A. Weighell and Thomas H. Summerson, visited steel foundries in some of the leading centers in America returning to England Friday, Oct. 25.

George Edwards, formerly with the Wheatley Bros. Brass Works, Tulsa, Okla., has become affiliated with the Standard Metal Works, Rockford, Ill.

A. E. Udell resigned as purchasing agent of the Oliver Farm Equipment Corp., Chicago. Mr. Udell reports that plans for the future are indefinite at the present time.

Fred L. Flanders, vice president of the Muskegon Motor Specialties Co., Muskegon, Mich., has been elected a director of the Sparta Foundry Co., Sparta, Mich.

Charles N. Guin, formerly cupola foreman at the U. S. Pipe & Foundry Co., Burlington, N. J., has accepted a position with the Rundle Mfg. Co., Milwaukee.

Henry O. Haughton, production engineer, Chevrolet Motor Co., gray iron foundry, Saginaw, Mich., has resigned to become associated with the Charles E. Bedaux Co. of Illinois, Inc., Chicago, industrial engineer.

E. F. Adriance, has resigned as assistant metallurgist for the Remington Typewriter Co., Ilion, N. Y., to accept the position of chief metallurgist for the W. A. Riddell Co., Bucyrus, O.

F. P. Norris, for 40 years identified with the Phoenix Iron Co., 22 South Fifteenth street, Philadelphia, has been appointed a vice president. For the past 28 years he has served as manager.

Erwin J. Mohr has been appointed manager of industrial sales of the Gunite Corp., Rockford, Ill., manufacturer of special ferrous metals for use in machine parts. Mr. Mohr served for many years as sales manager for the Kinite Corp., Milwaukee.

Open Hearth Furnace To Be Studied

The fall meeting of the open-hearth superintendent's committee of the American Institute of Mining and Metallurgical Engineers will be held at the Stevens hotel, Chicago, Nov. 5 and 6. A joint dinner with the Chicago branch of the Mining and Metallurgical Engineers' society will be held Nov. 6 in the Chicago Engineers' club following which details of the Stevens type open-hearth furnace will be presented.

To Handle Supplies

Utah Foundry Supply Co., 538 West Sixth street, south, Salt Lake City, has been established to deal in foundry equipment and supplies. The company also will handle alloying materials and sundries. P. F. Lambert is sales manager.

Newark Founders Meet

The first fall meeting of the Newark Foundrymen's association was held Oct. 23, at the Down Town club, corner of Broad and Market streets, Newark. This was a joint meeting with the Metropolitan section of the American Society of Mechanical Engineers. E. J. Lowry, consulting metallurgical engineer, Detroit, was the speaker of the evening and his subject was "A New Material: Still Called Cast Iron."

David B. Reeder has been appointed metallurgist of the Electro Metallurgical Sales Corp., 30 East Forty-second street, New York. His headquarters will be in Room 816, Oliver building, Pittsburgh. Mr. Reeder formerly was associated with Keystone Driller Co., Beaver Falls,

New Company Represents Many Manufacturers

Ohio Equipment Co. Inc., has been established with offices and display rooms at 5716 Euclid avenue, Cleveland. The company will represent a number of manufacturers of material handling equipment including the following: Yale & Towne Mfg. Co., Stamford, Conn.; Stuebing-Cowan division of the Yale & Towne Mfg. Co., Cincinnati; Economy Engineering Co., Chicago; American Kron Scale Co., New York and the Powell Pressed Steel Co., Hubbard, Ohio. E. M. Abramson is president and general manager and A. P. Carstensen is vice president.

Southern Metal Trades Association Meets

The eleventh annual meeting of the Southern Metal Trades association was held at Knoxville, Tenn., Oct. 16 and 17. The officers elected at that session are as follows: President, John S. Schofield, J. S. Schofield's Sons Co., Macon, Ga.; vice president, Paul R. Moore, Columbus Iron Works, Columbus, Ga.; treasurer, W. G. Mealor, Gainsville Iron Works, Gainesville, Ga. and secretary, William E. Dunn Jr., Atlanta, Ga.

Mr. Schofield succeeds George B. Cocker, Cocker Machine & Foundry Co., Gastonia, N. C. Upon retiring from the presidency, Mr. Cocker was presented with a silver service in appreciation of assistance rendered the association during his term as president of the association.

Quad-City Group Holds Interesting Meeting

Quad-City Foundrymen's association held its regular October meeting at the Fort Armstrong hotel, Rock Island, Ill., on Oct. 21. Louis Rasmussen, foundry superintendent, Nash Motors Co., Kenosha, Wis., spoke on the advances in foundry practice in the past ten years. He spoke of the various changes in practice during that period and gave some of his observations on the trend of modern foundry methods.

Obituary

Henry W. Milmine, formerly president and manager of Milmine & Co., Toledo, O., died at the home of his daughter at Toledo, Oct. 11, after an extended illness.

G. Theodore Shants, for the past 25 years president of the Kutztown Foundry & Machine Co., Kutztown, Pa., and Philadelphia district sales manager for the Lukens Steel Co., Coatesville, Pa., died recently at his home in Germantown, Philadelphia. Mr. Shants began his career 48 years ago as clerk with Wilson & Co., then sales agents for the Lukens company. When the Lukens company established its own sales office in Philadelphia, he became connected with it and later was appointed district manager. He was a member of the American Iron and Steel institute.

Frank Henderson, manager of the Cleveland office of the Combustion Engineering Corp., International Combustion building, 200 Madison avenue, Thirty-fifth to Thirty-sixth streets, New York, died Sept. 25. He was 53 years old. Mr. Henderson was born at Tuscola, Ill., on Feb. 11, 1876. He joined the Green Engineering Co., East Chicago, Ind., in 1898 and worked his way up in that organization as service man, tester and superintendent of service work. In 1922 when the Green Engineering Co. was absorbed by the Combustion Engineering Corp., Mr. Henderson, who was managing the Cleveland office of the Green company, was appointed district manager for the Combustion Engineering Corp.

David L. Eynon, president of the Pittsburgh Rolls Corp., Pittsburgh, died Oct. 5 while returning from a vacation in southern France. He was one of a group of Welshmen which contributed to the development of the roll turning, roll design and rolling mills in the American iron and steel industry. Mr. Eynon was born in Dowlais, Wales, Sept. 5, 1861. When 18 years old he located in Philadelphia, where he joined his cousin, William D. Eynon, then in charge of the roll shop of Hughes & Patterson. After a few years he left to take employment with the Pencoyd Iron Works, Philadelphia, now the Pencoyd works, American Bridge Co. His next connection was with a rolling mill company in Bridgeport, Conn., following which he went to the Colorado Fuel & Iron Co., Pueblo, Colo., and became associated with James E. Jones. In 1904, after a brief connection with the Jones & Laughlin Steel Corp., Pittsburgh, Mr. Eynon became identified with the Phoenix Roll Works, Pittsburgh, as superintendent. When that company was reorganized in 1917 as the Pittsburgh Rolls Corp., he became its first president and held this position until his death. He was a member of the American Iron and Steel institute and the American Foundrymen's association.

Offers Standard Samples

The bureau of standards has issued a bulletin on the various metals and alloys, and organic materials that it supplies as standard samples. At present there are 81 different samples including those of cast iron, steel, dolomite, fluorspar, ferroalloys, nonferrous alloys, tin, zinc, aluminum, copper and lead. Organic materials include benzoic acid, sodium oxalate, and naphthalene. Information is given on the prices of the standards and their analyses. The bulletin is entitled, "Supplement to Circular No. 25."

Foundry Association Directory

American Foundrymen's Association

President, FRED ERB, Erb-Joyce Foundry Co., General Motors building, Detroit; executive secretary treasurer, C. E. HOYT, 222 West Adams street, Chicago; technical secretary, R. E. KENNEDY, 222 West Adams street, Chicago.

Associated Brass Founders of New England

President, J. A. DUNCAN, Wm. Duncan & Sons Co., 166 Liverpool street, East Boston, Mass. Meeting the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. HIRE, Hire Foundry Co., Peoria, Ill.; secretary, FRANKLIN WHITEHEAD, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, H. P. EVANS, Pettibone-Mulliken Co.; secretary, ALBERT N. WALLIN, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, CARL S. NEUMANN, Union Mfg. Co., New Britain, Conn.; secretary CHARLES S. PARKER, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association

President RUSSELL M. SCOTT, Packard Motor Co., Detroit; secretary, WILLIAM J. MUHLITNER, Great Lakes Foundry Sand Co., Detroit. Meetings third Thursday in each month at appointed place.

East Bay Foundrymen's Association

Secretary O. R. MOLLER, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Gray Iron Institute

President, WALTER L. SEELBACH, Forest City-Walworth Run Foundries Co., Cleveland; Secretary, ARTHUR J. TUSCANY, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. FAUNTLEROY, Moline Malleable Iron Co., St. Charles, Ill.; secretary ROBERT E. BELT, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

Newark Foundrymen's Association

President, J. L. CARTER, Sachs-Barlow Foundries Inc., Newark; secretary W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President CARL S. NEUMANN, Union Mfg. Co., New Britain, Conn.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio Foundries Association Inc.

President, DON MCDANIEL, Hamilton Foundry & Machine Co., Hamilton, O.; secretary-manager, E. F. SCOTT, 418 Penton building, Cleveland.

Philadelphia Foundrymen's Association

President, C. F. HOPKINS, Ajax Metal Co., Philadelphia; secretary EARL SPARKS, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association

President, L. W. MESTA, Mesta Machine Co., Homestead, Pa.; secretary-treasurer WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, F. W. KIRBY, John Deere Spreader Works, East Moline, Ill.; secretary-treasurer, J. P. BOADEN, Union Malleable Iron Co., East Moline, Ill. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club

President, HORACE R. CULLING, Carondelet Foundry Co., St. Louis; secretary-treasurer, LEO J. FILSTEAD, John C. Kupferle Foundry Co., St. Louis.

Southern Metal Trades Association

President, JOHN S. SCHOFIELD, J. S. Schofield's Sons Co., Macon, Ga.; Secretary, W. E. DUNN JR., Flatiron building, Atlanta, Ga.

Steel Founders' Society of America

President, J. E. MCCAULEY, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; managing director, G. P. ROGERS, Graybar building, New York.

Tri-City Technical Council

Chairman, C. F. SCHERER, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. XANDER, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, WILLIAM HOPPENJANZ, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, GEORGE W. PIEHL, Weslsing Bros. Foundry Co., 1607 McLean avenue, Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, R. D. BONNEAU, Commutator Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

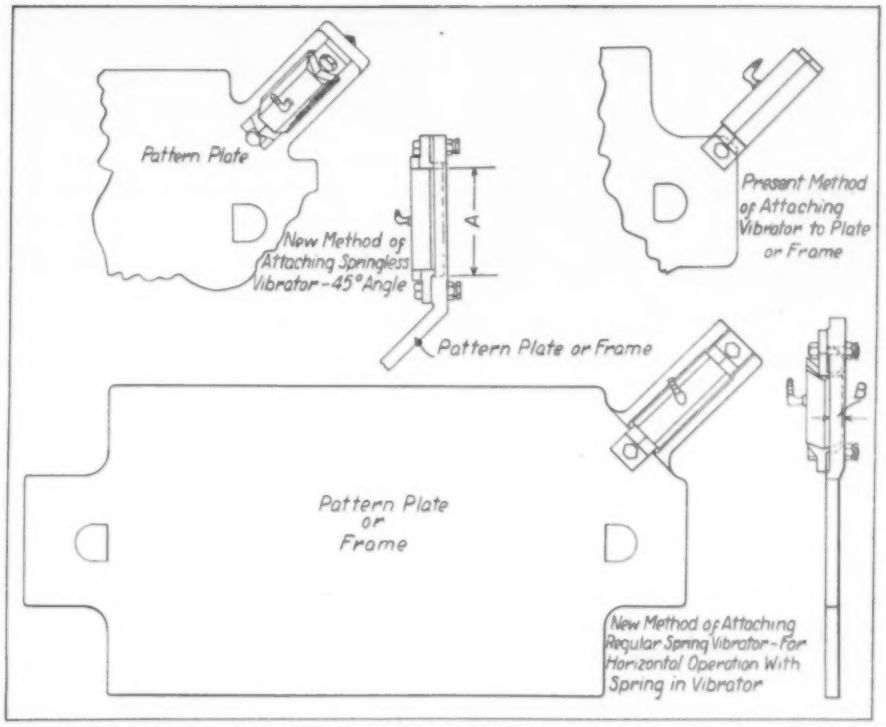
President, J. W. ORPHAN, Lake Union Foundry Co., 1703 Westlake avenue, Seattle; secretary, EDWARD C. GUSTIN, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Anneals Alloy Steel in Electric Furnace

General Electric Co., Schenectady, N. Y., has developed a new electric furnace to obtain variable heating and cooling cycles in annealing alloy steel. The following four features are claimed: Even and efficient heating at variable speeds as may be desired in the process; short or long cooling periods, controlled by the operator as desired; fast cooling without expensive wall construction and without air in contact with the work, thereby eliminating oxidation or decarburization; a high-grade product with unusual economies per ton of material in a relatively short time. The heating units of the new furnace are so distributed that *hot spots* are avoided.

The furnace walls are insulated in the same manner as those in furnaces operated continuously at higher temperatures. The furnace is lined with light-weight refractories of low thermal capacity. By the use of this type of refractory it is possible for the furnace walls to heat or cool quickly, giving flexibility to the heating and cooling cycles and increasing the furnace economy.

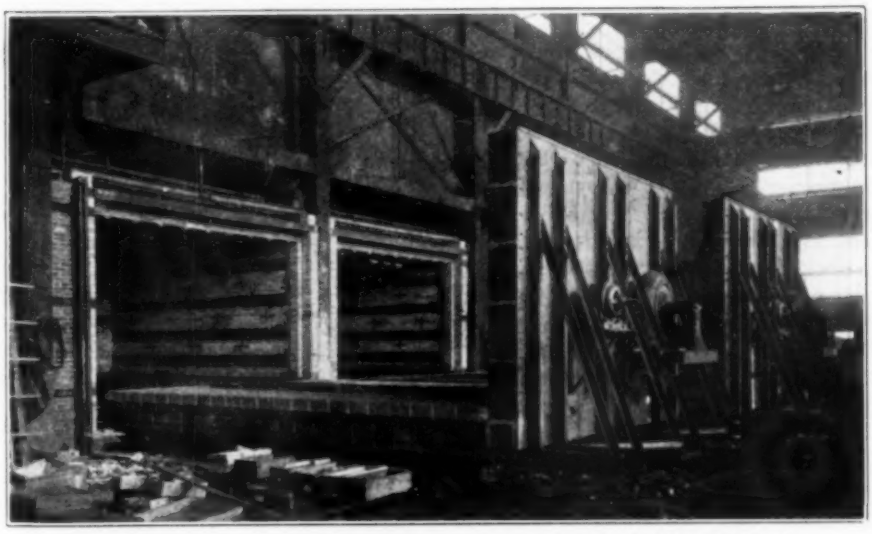
Variation of the cooling period is possible as a result of the use of cooling coils and a ventilating system that may be sealed tight by insulated doors during the heating period. These coils may be installed as desired in either or both the sides and bottom of the furnace. None of the cooling air enters the furnace chamber. The rate of cooling is varied by changing the amount of air blown through the ventilating system. The ventilation holes are fitted with sand-sealed, insulated covers to prevent heat leakage during the heating cycle. After the work is cooled by the cooling coils below the critical temperature, the covers may be opened and the cooling further accelerated by a flow of air into the bottom vents, through the furnace and out through the top vents. The covers may be opened to any extent by the use of a single control.


Pattern Plate
New Method of Attaching Springless Vibrator-45° Angle
A
Present Method of Attaching Vibrator to Plate or Frame
Pattern Plate or Frame
Pattern Plate or Frame
B
New Method of Attaching Regular Spring Vibrator-For Horizontal Operation With Spring in Vibrator

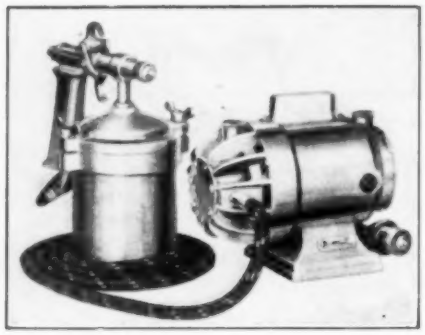
ACCORDING TO THE NEW METHOD THE VIBRATOR IS ANCHORED BY TWO BOLTS IN A RECESS IN A LUG ON THE PATTERN PLATE

Introduces New Idea for Holding Vibrator

Malleable Iron Fittings Co., Branford, Conn., has developed what is claimed to be a new and improved method of attaching a vibrator to a pattern plate or frame as shown in the accompanying illustration. Formerly, it may be noted the general practice was to attach the vibrator by a single bolt. In many of the vibrators returned to the company for servicing, it was found that the bolt hole in the head of the vibrator was elongated and that in many instances the bolts were reduced to half their original diameter in the area which extended through the pattern plate. This condition indicated a long period of service under improper fastening with consequent loss of vibrating action on the pattern and damage to the plate and vibrator head. In the improved method shown, a shoulder on the vibrator head comes in direct contact with a corresponding shoulder on the pattern plate lug. Also two bolts are employed instead of one. It is claimed that the snugly fitting shoulders and the two bolts mean a permanent attachment. The method has been used by the company for some time on its shakeout bail legs and in vibrating chutes, hoppers and other devices, but the application to pattern plates and frames is a new departure. It is pointed out that the addition of the lug to a pattern plate presents no difficulty and the machining of the points of contact and drilling an extra hole are items of little moment. For ease of machining some patternmakers may prefer to make the thickness at the point marked B the same as that in the remainder of the plate, thus obviating blocking up the casting on the table of the planer or milling machine. In the illustration, the lug is thicker to provide greater strength without making the lug too large.



THE HEATING UNITS ARE DISTRIBUTED TO GIVE UNIFORM HEATING



THE DEVICE IS BUILT OF ALUMINUM CASTINGS

Introduces New Electric Paint Sprayer

Breuer Electric Mfg. Co., 852 Blackhawk street, Chicago, has introduced a new compressor type, portable, electric, paint spray machine for touching-up work, shading, light finishing and refinishing jobs and for semiproduction and maintenance industrial painting work. The device is of the rotary compressor type, is built of aluminum castings, and is equipped with a 1/3 horsepower motor made by the General Electric Co. Compressor unit weighs 7 pounds and develops a pressure of over 35 pounds. The spray gun is equipped with two tips, one for a fan spray and the other for a narrow spray. The maximum covering area of these tips is 14 inches and the minimum 2 inches. An adjusting screw controls the amount of paint used. The gun weighs 2 pounds. Accessories include two tips, 20 feet of reinforced rubber covered cord and 8 feet of rubber web covered hose.

Linseed Oil Companies in Merger

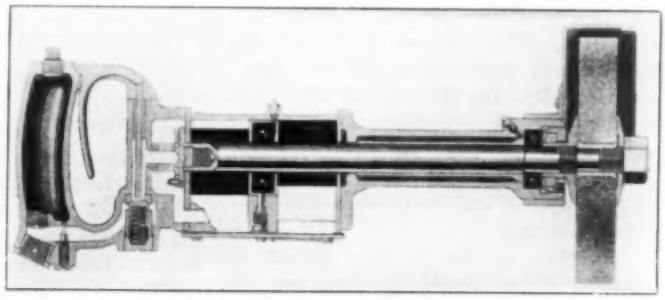
An amalgamation has been effected between the Werner G. Smith Co., Cleveland and the Archer-Daniels-Midland Linseed Co., Minneapolis. The latter company, one of the largest manufacturers of linseed oil in the country with plants and storage facilities at Minneapolis, Milwaukee, Chicago, Toledo, O., Buffalo and Edgewater, N. J., has acquired a substantial interest in the former company. There will be no change in the name of the organization, personnel or methods of the Smith company, which will continue to serve the foundry industry.

Chain Belt Co., Milwaukee, has moved its offices from 1000 Marine Bank building to 1310 Second National Bank building, Houston, Tex.

Portable Grinder Weighs Sixteen Pounds

Rotor Air Tool Co., Cleveland, recently has introduced a new type portable grinder designed for 1 x 8 inch high speed rubber, bakelite and elastic bonded wheels. It is equipped with a new type rotor and governor and operates at a speed of 4300 revolutions per minutes under load. The rotor governor controls the speed by regulating the air intake and keeping the machine at constant speed under load.

Rotors supplied with the machine are of a new type and are balanced so that there is little vibration when the tool is in use. It is claimed that this feature prevents the wheels from wearing out of round and increases their life. The new model portable grinder weighs 16 pounds.



Rubber, Bakelite or Elastic Bonded Wheels May Be Used With This Machine

Roller Bearing Is Made of Alloy Steel

Hyatt Roller Bearing Co., Newark, N. J., has introduced a new type roller bearing that is interchangeable with standard S. A. E., single-row, ball bearings. It is designed for positions in which space limitations exist and loads beyond the capacity of ball bearings must be sustained. The outer and inner race in this type bearings are separable and the rollers are retained permanently in the outer race.

A separator, floating on the rollers, spaces them properly and heat treated end rings retain them endwise within the outer race. The end rings and separator function to keep the rollers in proper alignment insuring positive contact along their entire length. Rollers and races are made of chrome-nickel alloy steel, while the end rings are made of vanadium steel to eliminate wear by the ends of the rollers. The separator is made in such a manner that the pockets are parallel and equally spaced, which assures uniform load distribution.

The various parts of the bearing are of standard S. A. E. metric dimensions and the possible separation of the two parts of the bearing offer opportunities for developing more economical assembly. The roller ends are rounded sufficiently to facilitate assembly where the inner race is not used. Both races are chamfered at one end.

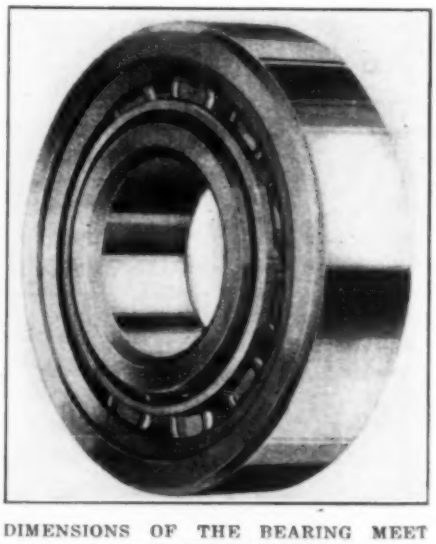
Bill Talks on Rings

(*Concluded from Page* 933)

"In one of the plants of a prominent electrical company, large transformer boxes are made in the manner outlined. However, several features are different. The thickness of the cast iron rim is sufficient to insure a liquid condition for a period long enough to raise the steel to a fusing temperature. The steel plate forming the body of the box is corrugated vertically and naturally will yield to the contracting cast iron to an extent that will prevent the cast iron from cracking. The 2-foot square box presents an unyielding contour.

"The job reminds me," Bill said reminiscently, "of a story I heard the other day about a party of tourists visiting an old church or an abbey or something of the kind to be found here and there in England. 'That window,' said the guide, pointing, 'goes back to William the Conqueror.'

"'What's the matter with it?' one of the nosey tourists inquired, 'don't it fit?'"



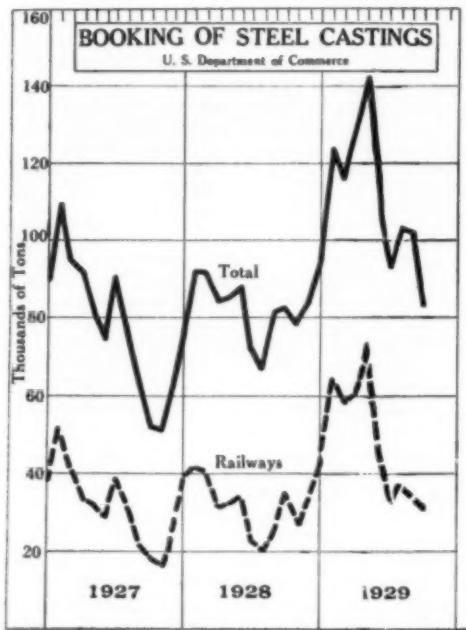
DIMENSIONS OF THE BEARING MEET S. A. E. SPECIFICATIONS

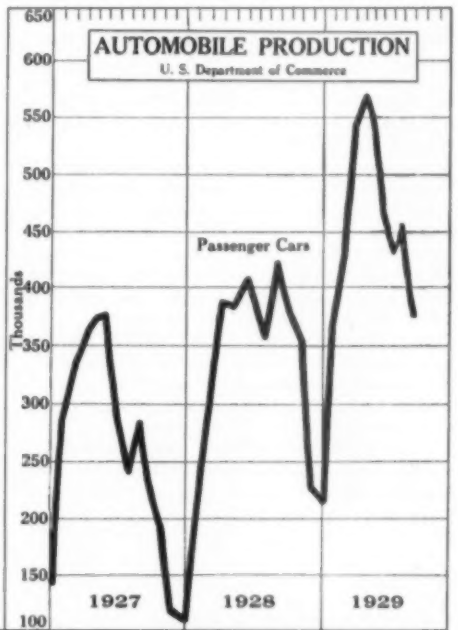
Trade Trends in Tabloid

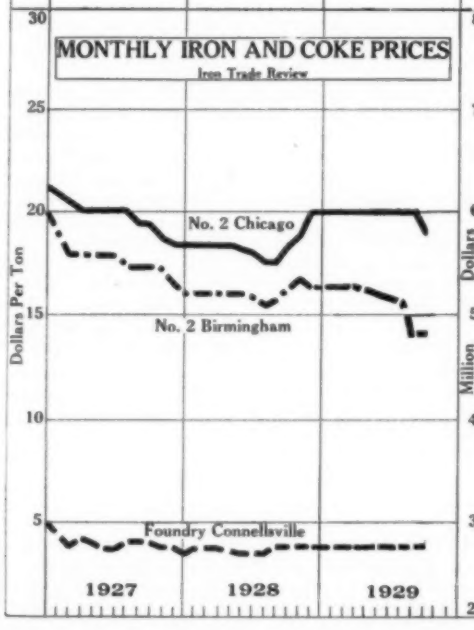
INCREASED buying of freight cars is helping to offset the decrease in demand for castings caused by a decline in automobile production. Car awards for the first half of October totaled 16,887, surpassing the total for any full month thus far this year. Car builders anticipate awards for 20,000 cars before January and 100,000 cars annually for the next five years. Passenger cars produced in September totaled 376,361 as compared with 454,019 cars in August. The drop in production in October probably was sufficient to bring the total for that month below the output for October, 1928. Building construction in September declined sharply from the preceding month. Awards for the first 10 months are considerably below the corresponding period last year. Steel casting orders are sufficient to maintain operations around 60 per cent. Production of malleable castings dropped to the lowest point of the year with an output of 57,380 tons. Report of the Gray Iron institute shows production in September as 140 per cent of normal compared with 123 per cent in August. However, new business declined from 122 per cent of normal in August to 103 per cent in September. Midwestern stove foundries and implement manufacturers are busy. Sanitary ware plants and stove foundries in the west are operating on good schedules, but little improvement is noted among jobbing foundries.

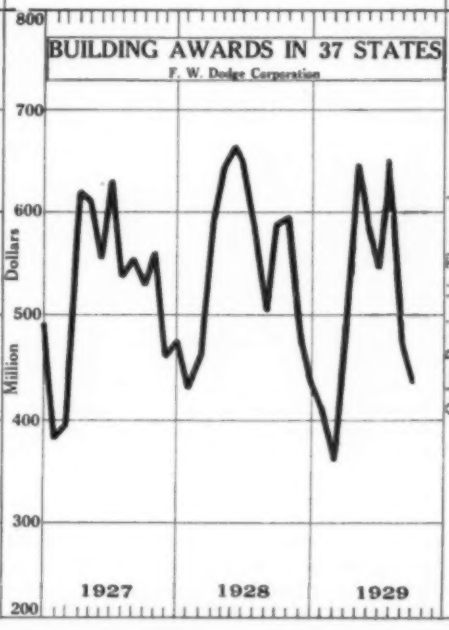
RAW MATERIAL PRICES
Oct. 22, 1929

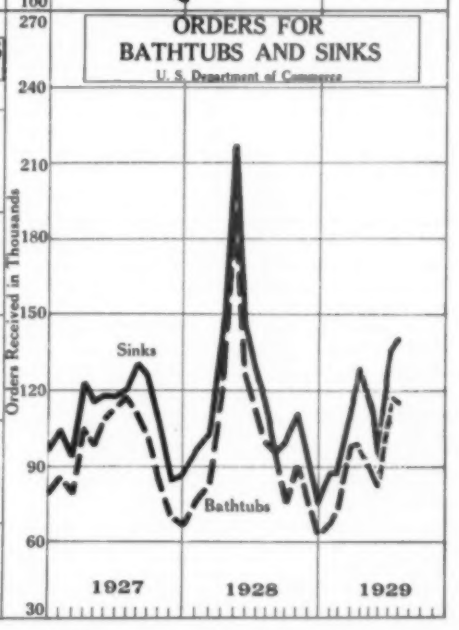
Iron	
No. 2 foundry, Valley	$18.50
No. 2 southern, Birmingham	14.50
No. 2 foundry, Chicago	20.00
No. 2 foundry, Philadelphia	21.76
No. 2 foundry, Buffalo	19.50
Basic, Valley	18.50
Basic, Buffalo	18.50
Malleable, Chicago	20.00
Malleable, Buffalo	20.00
Coke	
Connellsville beehive coke	$3.75 to 4.85
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.50 to 9.00
Scrap	
Heavy melting steel, Valley	$17.00 to 17.50
Heavy melting steel, Pitts.	17.00 to 17.50
Heavy melting steel, Chicago	14.25 to 14.75
Stove plate, Buffalo	12.50 to 12.75
Stove plate, Chicago	11.00 to 11.50
No. 1 cast, New York	12.50 to 13.00
No. 1 cast, Chicago	14.00 to 14.50
No. 1 cast, Philadelphia	16.00
No. 1 cast, Pittsburgh	15.00 to 16.00
No. 1 cast, Birmingham	14.00 to 15.50
Car wheels, iron, Pittsburgh	15.50 to 16.00
Car wheels, iron, Chicago	14.00 to 14.50
Railroad malleable, Chicago	17.00 to 17.50
Malleable, Buffalo	17.50 to 18.00
Nonferrous Metals	**Cents per pound**
Casting, copper, refinery	17.37½ to 17.50
Electro, copper, producers	18.00
Straits tin	41.12½
Lead, New York	6.90
Antimony, New York	8.62½ to 8.75
Nickel, electro	35.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	17.00 to 17.50
Zinc, East St. Louis, Ill.	6.70











What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Lavelle Foundry Co., Anderson, Ind., recently was damaged slightly by fire.

Bantam Ball Bearing Co., Bantam, Conn., has added a brass brass foundry to its plant at South Bend, Ind.

Piston Ring Castings Inc., St. Louis, has been incorporated with $90,000 capital, by Henry Haacke, 5544 Maze place.

Easton Art Metal Co. Inc., Easton, Pa., has been incorporated with $5000 capital to manufacture castings, forgings, etc. Joseph Bolinsky, 1007 Washington street, is treasurer.

R. J. Tower Iron Works Inc., 429 East Grove street, Greenville, Mich., has been incorporated with $150,000 capital by Francis E. Tower to operate a foundry and machine shop.

Wadsworth Foundry Co., Wadsworth, O., soon will start construction of an addition, 45 x 100 feet, which will increase production about 30 per cent.

Hayes Custer Stove Co., 700 East Empire street, Bloomington, Ill., contemplates the construction of a 1-story foundry addition. (Noted Sept. 1.)

The Motor Car Ventilator Corp., Suffolk, Va., is completing a new aluminum foundry which will be in operation about Nov. 1. R. G. Ederton is president.

The stove plant owned by Morash Stove Co., Morrisburg, Ont., was recently damaged by fire with loss of $100,000. Owners contemplate rebuilding.

Mahan Foundry Co., Miami Chapel road, Dayton, O., has purchased the 2½-acre tract and plant formerly occupied by the Standard Scale Co. for expansion purposes.

General Laboratories Inc., Boston, has been incorporated with $200,000 capital to engage in business as toolmakers, brass founders, boilermakers, research engineers, etc. John Nelson, 48 Union Park street, is president.

National Electric Mfg. Co., which operates a foundry and machine shop at Florence, Ala., for the manufacture of stoves and ranges, is reported to have acquired a site and is considering moving its plant to Jackson, Miss.

Electric Auto-Lite Co., Champlain and Mulberry streets, Toledo, O., manufacturer of starting equipment and electric lights, will start immediate construction of a branch manufacturing plant at Sarnia, Ont. Estimated cost is about $150,000.

Locomotive Finished Material Co., Atchinson, Kans., has started construction of a foundry addition, 115 x 400 feet, and a material building, 86 x 300 feet. The buildings will be equipped with 30-ton and 10-ton cranes. (Noted Oct. 15.)

Birmingham Stove & Range Co., Birmingham, Ala., has announced an enlargement program that will include additional units increasing capacity considerably. The company manufactures stoves and ranges, gas heaters, grates and holloware.

The plant of the Atlas Foundry Co., 3012 Wilkeson street, Tacoma, Wash., recently was damaged by fire to the extent of $15,000. A permit has been granted the company for the construction of a plant to replace that damaged.

Commerce Pattern Foundry & Machine Co., 2211 Grand River avenue, Detroit, is building a $30,000 addition to its plant for the manufacture of machine tools. Contract for design and construction has been awarded to Austin Co., Cleveland.

Spring City Foundry Co., Waukesha, Wis., has started construction of a plant addition. Sand handling and conditioning equipment, new cupolas and charging equipment will be installed. Estimated cost of improvements is about $150,000.

A. Moe & Co. Inc., Philadelphia, has been incorporated with $10,000 capital to manufacture, repair and sell marine engines, welding equipment and supplies and to carry on a business of iron and brass founders. Martha L. Christensen, 5651 North Mascher street, is treasurer.

Monroe Steel Casting Co., Monroe, Mich., is rebuilding its foundry. The new building will be 50 x 190 feet. The company is installing a 5-ton capacity crane, a 3-ton capacity electric melting furnace made by the Pittsburgh Electric Furnace Corp., Pittsburgh, core ovens and a sandblast barrel made by the American Foundry Equipment Co., Mishawaka, Ind. The additional equipment will increase the capacity 50 per cent.

New Trade Publications

VENTILATORS—Swartwout Co., 18511 Euclid avenue, Cleveland, has issued a folder on its rotary, ball bearing ventilators.

BLOWERS—Connersville Blower Co., Connersville, Ind., has issued a folder on its rotary, positive blowers for medium ranges of capacities and pressures and suctions.

DRYING EQUIPMENT—Drying Systems, Inc., 1800 Foster avenue, Chicago, has issued a bulletin of its unit type, induced draft heaters for drying and baking processes.

ELEVATORS—Revolvator Co., 336-352 Garfield avenue, Jersey City, N. J., in a current bulletin illustrates various methods of piling case goods with the use of the portable elevator that it manufactures.

CRANES—H. D. Conkey & Co., Mendota, Ill., has issued a folder on its single, I-beam, underhung cranes. It shows the details of construction, outstanding features, and gives a table of data on their various capacities.

WELDING APPARATUS—Harris Calorific Co., Cleveland, describes its gas welding accessories in a current catalog. The apparatus includes generators, torches, regulators, hose fittings, manifolds, needle valves, etc. The bulletin is well illustrated.

WELDING EQUIPMENT—Torchweld Equipment Co., Chicago, recently has issued a bulletin on its welding and cutting equipment. The booklet describes and illustrates torches, tips, gages, rods, generators, etc. Sectional views of the equipment feature the bulletin.

REFRACTORIES—Charles Taylor Sons Co., Cincinnati, manufacturer of fire brick, has issued a booklet on refractories for special requirements. The special grades available for unusual conditions are described and their characteristics are given.

TRAMRAILS—Cleveland Electric Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O., has issued a folder on its tramrails equipped with drop sections. The units may be used for dip cleaning and painting of materials, dyeing of textile yarns and fabric, etc.

STARTERS—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., recently has issued two folders describing the features, application, operation and construction of magnetic resistance type starters for squirrel-cage induction motors and magnetic starters for wound rotor induction motors.

COMPRESSORS—Pennsylvania Pump & Compressor Co., Easton, Pa., has published a 24-page bulletin on its single-stage, double-acting, straight-line air compressors and vacuum pumps. The booklet contains illustrations and descriptions of the machines and their parts and shows sectional installation views. Tables of specifications also are included.

MAGNETIC SEPARATORS—Magnetic Mfg. Co., Milwaukee, has issued an 8-page circular on its magnetic separator for use in various industrial plants for the removal of tramp iron from different substances. Illustrations of typical installations and drawings of several types of machines are included together with a partial list of users.

BOILERS—Combustion Engineering Corp., International Combustion building, 200 Madison avenue, New York, describes its pulverized fuel systems, furnaces for pulverized fuel, air preheaters, various type stokers, and several types of boilers in a current catalog. It also contains a list of factors to be taken into consideration when installing steam generating units.

WELDING—Linde Air Products Co., New York, is circulating a bulletin on the welding of aluminum and its alloys. It contains a discussion of the current practices in welding commercial grades of aluminum and describes the technique necessary on various types of jobs. The bulletin is well illustrated with views of different type jobs.

ELECTRIC LOCOMOTIVES—Baldwin Locomotive Works, Philadelphia and the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., jointly have published a 24-page bulletin on mine and industrial locomotives. Performance, weight, electrical and mechanical equipment and dimensions are given with a blueprint of each type engine. An illustration of each locomotive accompanies the data.

LADLES—Whiting Corp., Harvey, Ill., recently issued a 24-page bulletin on its ladles. Helical-worm, worm and pin, spur geared, truck, bottom-tap, teapot spout, shank, trolley, hand and reservoir ladles are described and illustrated. Tables of specifications accompany the views. Repair parts for various types of ladles are illustrated. The latter part of the booklet is devoted to the care of that equipment.

CRANES, SHOVELS, DRAGLINES — Link-Belt Co., 300 West Pershing road, Chicago, has issued a bulletin on the cranes, shovels and draglines that it manufactures. The first part of the bulletin is well illustrated with reproductions from photographs of the various crawler type cranes showing the details of construction and use under different conditions. Drawings of the different types with safe lifting capacities, clearance dimensions, operating data for each are included. The latter part of the bulletin is devoted to illustrations, drawings, tables of safe lifting capacities and clearance dimensions of the diesel, gasoline, electric and steam locomotive cranes that the company manufactures.